DECEMBER 4, 1950

Electrical World

A McGRAW-HILL PUBLICATION

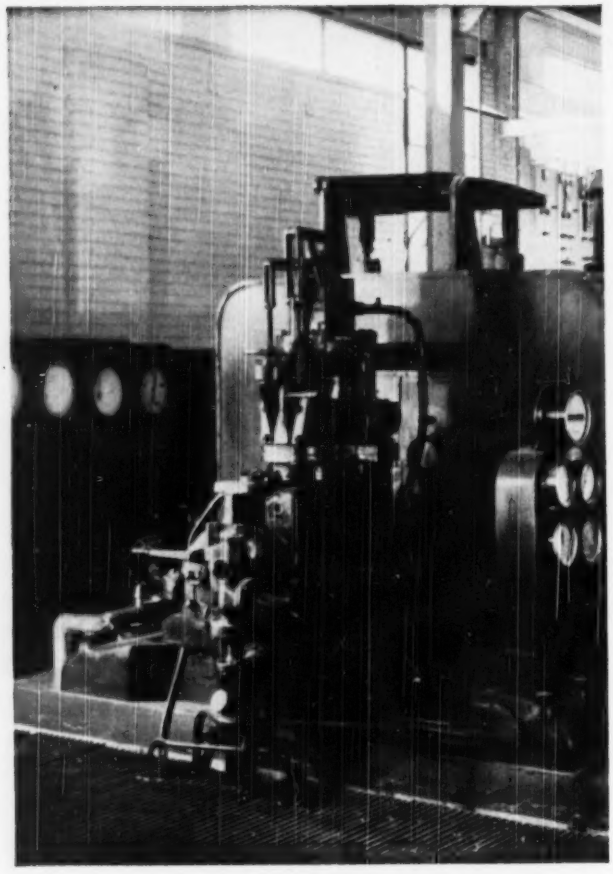
Dunkirk Station

Aerial Cable Installed on Bridge

Kilovar Supply and Voltage Control

Merits of the 30-amp Meter

NO RUST
NO SLUDGE
NO FOAM



When turbines are protected with TEXACO REGAL OILS (R&O)

WITH *Texaco Regal Oils (R & O)* you can be sure of rust-free, sludge-free, and foam-free turbine operation. High refinement plus effective additives and special processing give *Texaco Regal Oils (R & O)* a big edge over ordinary oils for long-lasting *sure* turbine protection.

Severest service is a challenge easily met by *Texaco Regal Oils (R & O)*. They guard bearings fully at all times . . . keep governor action instantly responsive . . . have extra-long life. *Texaco Regal Oils (R & O)* are available in the proper viscosities for every need and meet the rigid requirements of all leading turbine builders.

Let a Texaco Lubrication Engineer help protect your turbine investment. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

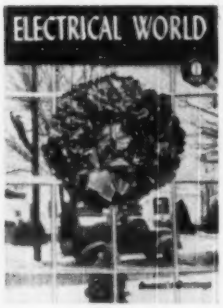
TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

A COVER PICTURE

Last week we saw a rough layout of **Electrical World's** Christmas cover (for the issue of Dec. 18). It reminded us of last year's Christmas picture, reprinted below.



We found a nice picture window in Port Washington and a homey, "Christmasy" house in Westchester with an electric light pole in just the right place.

Then we called Bill Brady, public relations director at Con Edison, to locate a lineman who would climb up the pole and wave a Christmas greeting. He referred us to Bill Stevens at Westchester Lighting who said to call his superintendent of distribution and **he** told us to get in touch with Yonkers Electric Light Co. Nobody was being evasive — they merely wanted to help us choose a lineman who worked near the scene.

Finally, at Yonkers Electric Light & Power Co they said "Okay, we'll lend you a lineman. When do you want him"?

"The first time it snows," said our managing editor.

We prayed for snow for a solid week. If you remember last year's mild winter, you know that our prayers were unavailing.

A wet, half-hearted snow-fall finally came along on a Saturday. Deadline for the picture was the following Monday.

Nobody could be reached over the weekend. The managing ed and the art director both on the verge of panic by Monday morning, rushed to Yonkers, gathered up lineman and props, and shot the picture just as the last of the snow vanished and the grass peeped through. It didn't snow again until January.

THE EDITORS

Electrical World

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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AFTER 16 YEARS LEAD-SHEATHED POWER CABLE STILL SHOWS NO CORROSION

OKOSHEATH

PROTECTIVE COVERING

Over 16 years ago, in a duct line known to be highly corrosive to ordinary lead cable sheathing, a 150-foot test section of Okonite-Callender paper insulated cable with Okosheath Protective Covering was installed by a major utility. At the same time, a similar cable, protected with ordinary covering, was installed under identical conditions.

Periodic inspections were made of both cables. After 4 years the cable with the usual covering was eliminated from the test, due to excessive deterioration. Yet 12 years later, in November, 1949, when the cable with the Okosheath Protective Covering was last inspected, the lead sheath showed no signs of corrosion whatsoever!

This cable showed but little deterioration of the outer covering in spite of the abnormal abrasion caused by continued pulling in and out of the ducts for periodic examination. With the lead sheath untouched by corrosion this cable can be expected to deliver many more years of service.

OTHER INSTALLATIONS SHOW SIMILAR RESULTS

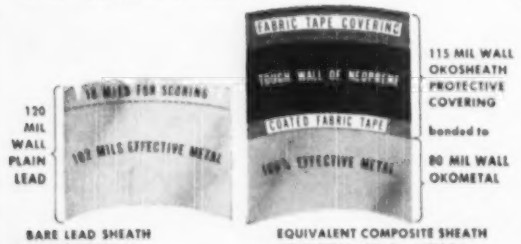
24,000 feet of Okosheath Protective Covered 138 KV oil-filled cable were installed in a severely corrosive salt marsh in 1937. Cable covering was as good as new when inspected after 11 years of service.

In another installation in the South, cable with Okosheath Protective Covering was still operating successfully after 10 years, whereas a cable with unprotected lead sheath failed in 7 years. Bulletin EW-1047 gives technical data on Okometal-Okosheath. Write us today for a copy. The Okonite Company, Passaic, N. J.

. . AND TODAY'S IMPROVED COMPOSITE SHEATH WITH *OKOSHEATH AND OKOMETAL* IS EVEN BETTER

Continuous improvement in the neoprene-compounded protective covering, applied by Okonite's strip process, plus newly-developed lead alloy sheath makes Okonite-Callender cables even longer-lived.

The illustrations below show the structural superiority of Okometal plus Okosheath Protective Covering. This dual sheath consists of a tough, reinforced Okosheath Protective Covering bonded to an Okometal sheath of reduced thickness and possessing greatly increased resistance to bending fatigue. The combination of these two provides 6 major advantages, available in no other cable: *double the life expectancy, elimination of corrosion, reduced installation and maintenance costs, greater bursting strength, no scoring of lead, and easier pulling.*



BARE LEAD SHEATH
Standard AEIC Thickness (120 mils)

EQUIVALENT COMPOSITE SHEATH
OKOMETAL of Reduced Thickness (80 mils)
plus OKOSHEATH Protective Covering

Okonite-Callender cables with this composite sheath meet all AEIC Test requirements for paper cables with plain lead of standard thickness.

8502

OKONITE-CALLENDER paper insulated power cables

ANCHORAGE for the NEUTRAL SUPPORTED SYSTEM OF SERVICE DROPS . . .

PAT. PEND.

Electroline Automatic Dead End

The 3800 Series Service-Drop Automatic Dead End, for holding pre-assembled service cable that uses a bare neutral conductor as the messenger. This service-drop dead end is assembled as a one-piece unit, with no loose parts to be dropped or lost. It has one end of the flexible bail detachable for installation around a spool type insulator or other supporting anchorage—permitting quick and easy installation. Only one part, other than the conductor, is handled by the lineman. This Electroline Automatic Service-Drop Dead End can be reclaimed and used again. But, once it is installed, it cannot become detached until conductor is removed by the lineman. The practice of gripping the bare neutral employed by the Electroline method of dead ending eliminates the danger of destroying the insulation and short circuiting phase wires.

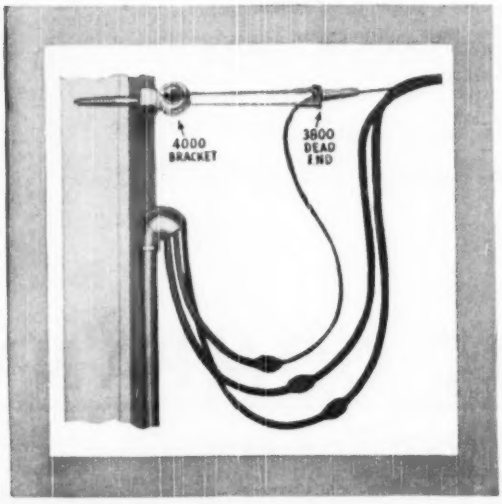
Electroline Anchor Bracket

The 4000 Series Service-Drop Anchor Bracket securely supports the cable at any angle. It is so designed that a closed bail or loop can be easily inserted without opening the loop. This one-piece, light weight unit reduces installation costs and no previous experience is necessary to install it.

The 4000 Bracket eliminates the insulator and insulator hardware at the building.

Two types are available: one with a $\frac{1}{2}$" diameter galvanized lag screw in lengths from 3" to 5" inclusive. The other type contains a $\frac{1}{2}$-13 galvanized nut for use in installations where a threaded end of bolt extends through wall of building.

The Electroline 4000 Series Anchor Bracket is made of aluminum and a galvanized steel lag screw, or nut to withstand corrosion and the discoloration of outside building walls . . . it is vibration-proof and fool-proof.



Both the Electroline Service-Drop Automatic Dead End and Anchor Bracket are designed to harmonize with residential and commercial buildings.

Write for new bulletins for complete details.

Electroline Company

4121 South La Salle Street Chicago 9, Illinois

IN CANADA
POWERLITE DEVICES, LTD., TORONTO

A New Fuse FOR THE NEW FUSING CONCEPT—

ANNOUNCING AT THIS TIME additional voltage ratings, a choice of time-current characteristics, and other important new features, we remind you that the SMD-2 is a modern fuse so far advanced in design that the present concepts of high voltage fuse application must be expanded if full advantage is to be taken of the economy inherent in fuse protection of transmission and sub-transmission systems.

✳ **FULL COVERAGE PROTECTION IS:** the new concept of transformer fusing in which:

1. A primary fuse is applied for both primary short circuit and secondary back-up short circuit protection.
2. A fuse is expected to perform dependably regardless of type of system; type of fault current; type of application; or system and atmospheric conditions.

✳ **FULL COVERAGE PROTECTION PROVIDES**— along with the above protection— savings in operating expense by:

1. Eliminating the need for replacement of "suspect" fuses on other phases when one fuse blows.
2. Eliminating the need for periodic replacement of fuses to prevent "sneak-outs" caused by vibration- or age-weakened fusible elements.

✳ **FULL COVERAGE PROTECTION REQUIRES:**

- A. dependable high and low fault-current interrupting ability;
- B. protection against dielectric breakdown or external flashover from severe recovery voltage;
- C. a fine degree of accuracy in time-current characteristics;
- D. a "non-damageable" fusible element which cannot be injured by surge currents, vibration, or aging;
- E. a choice of time-current characteristics to provide flexibility in coordinating with other primary, and with the secondary, protective devices.

The SMD-2 offers short circuit interrupting capacity many have thought could only be obtained with a circuit breaker; yet it is more reliable than a breaker. And the SMD-2 costs so much less that economic necessity need no longer compel a choice between the expense of a breaker or the often used expedients of solid tie, grounding switches, or remote-trip-relay protection, when tapping transmission and sub-transmission lines.

Permanent accuracy of the SMD-2 time-current characteristics permit sufficiently close fusing of the transformer bank to get back-up protection in case of secondary bus faults or failure of secondary protective devices—and this protection is accomplished without incurring outages caused by unwanted fuse operations.

The importance of fusing for secondary protection has been demonstrated by field experience which has shown that more than half of the operations of fuses thus applied were caused by secondary faults that most certainly would have damaged or destroyed the transformers. With the SMD-2 this valuable secondary protection is obtained in addition to a full measure of primary protection.

SMD-2 HIGHLIGHTS

Voltage Range: 34,500 to 138,000.

Interrupting Ratings: to 1,000,000 KVA.

In fuses of low ampere ratings, low fault currents are positively interrupted by an auxiliary gas-blast arc extinguisher.

Drop-out release is protected against opening from vibration or shock by a floating, self-aligning, latch mechanism.

Drop-out, when intended, is assured by a powerfully spring driven pry out lever, and a "wiping-in, rolling-out" contact design.

Initial and permanent accuracy of time-current characteristics are provided by non-damageable fusible elements.

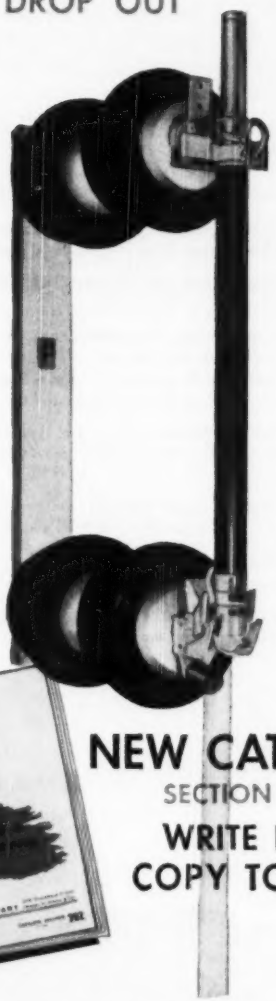
For a complete account of this new protective device you should have the new Catalog Section 262, now ready. Write for a copy today!

S&C ELECTRIC COMPANY

Formerly SCHWEITZER & CONRAD, INC.

*Full Coverage**

SMD-2 POWER FUSE
DROP OUT



NEW CATALOG
SECTION 262

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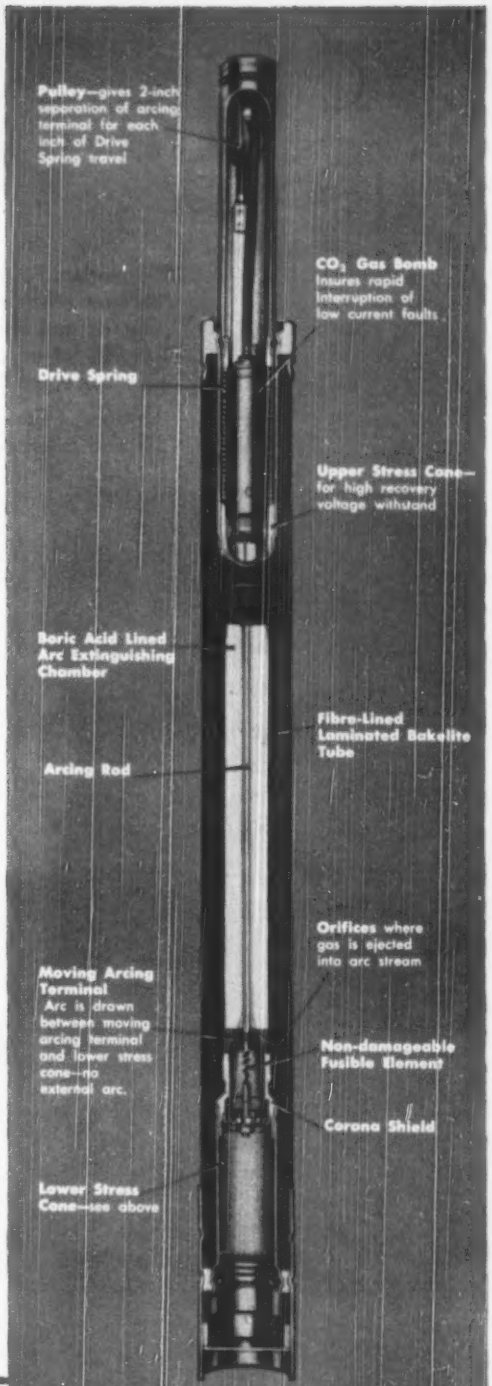
In Canada, Powerlite Devices, Limited, Toronto

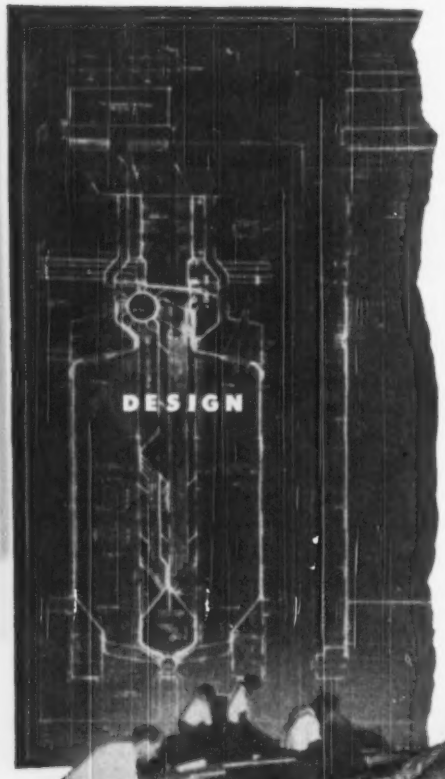

Pulley—gives 2-inch separation of arcing terminal for each inch of Drive Spring travel
CO_2 Gas Bomb Insures rapid interruption of low current faults
Drive Spring
Upper Stress Cone—for high recovery voltage withstand
Boric Acid Lined Arc Extinguishing Chamber
Fibre-Lined Laminated Bakelite Tube
Arcing Rod
Orifices where gas is ejected into arc stream
Moving Arcing Terminal Arc is drawn between moving arcing terminal and lower stress cone—no external arc.
Non-damageable Fusible Element
Corona Shield
Lower Stress Cone—see above

CUTAWAY VIEW OF FUSE UNIT

Milestones of engineering

The modern Foster Wheeler Steam Generator, heart of many of the most efficient central station and industrial power plants in America and elsewhere, reflects the engineering and production ingenuity of an organization long recognized as a pioneer and innovator in the field of steam generation.

The story of Foster Wheeler achievement is best revealed by the following milestones of engineering progress:



1898—**Aero pulverizers** firing various fuels applied successfully on a commercial scale.

1902—**Superheated steam introduced** commercially in the United States.

1904—**Convection superheaters** standardized with cast iron, extended surface rings applied to steel tubes. Bare tubes later used with improved design technique and improved metal selection.

1912—**Air preheaters** of tubular type built and operated. Plate type heaters followed a few years later.

1917—**Water tube boilers** designed for production on a large scale—both oil and coal fired.

1919—**Economizers** of high pressure, extended surface, unit type introduced.

1919—**Radiant superheaters** developed after long research and experimentation.

EXPERIENCE...the priceless

progress

1924—Water walls and water backs applied to many types of furnaces burning various fuels.

1934—Pulverized anthracite burned in direct-fired system eliminating need for pulverized fuel storage.

1935—Radiant reheaters and radiant superheaters installed in one of the first large high pressure reheat units in the country.

1936—Twin furnace steam generators of the separately-fired superheater type (shown upper right) developed to give steam temperature control over load ranges up to 10 to 1.

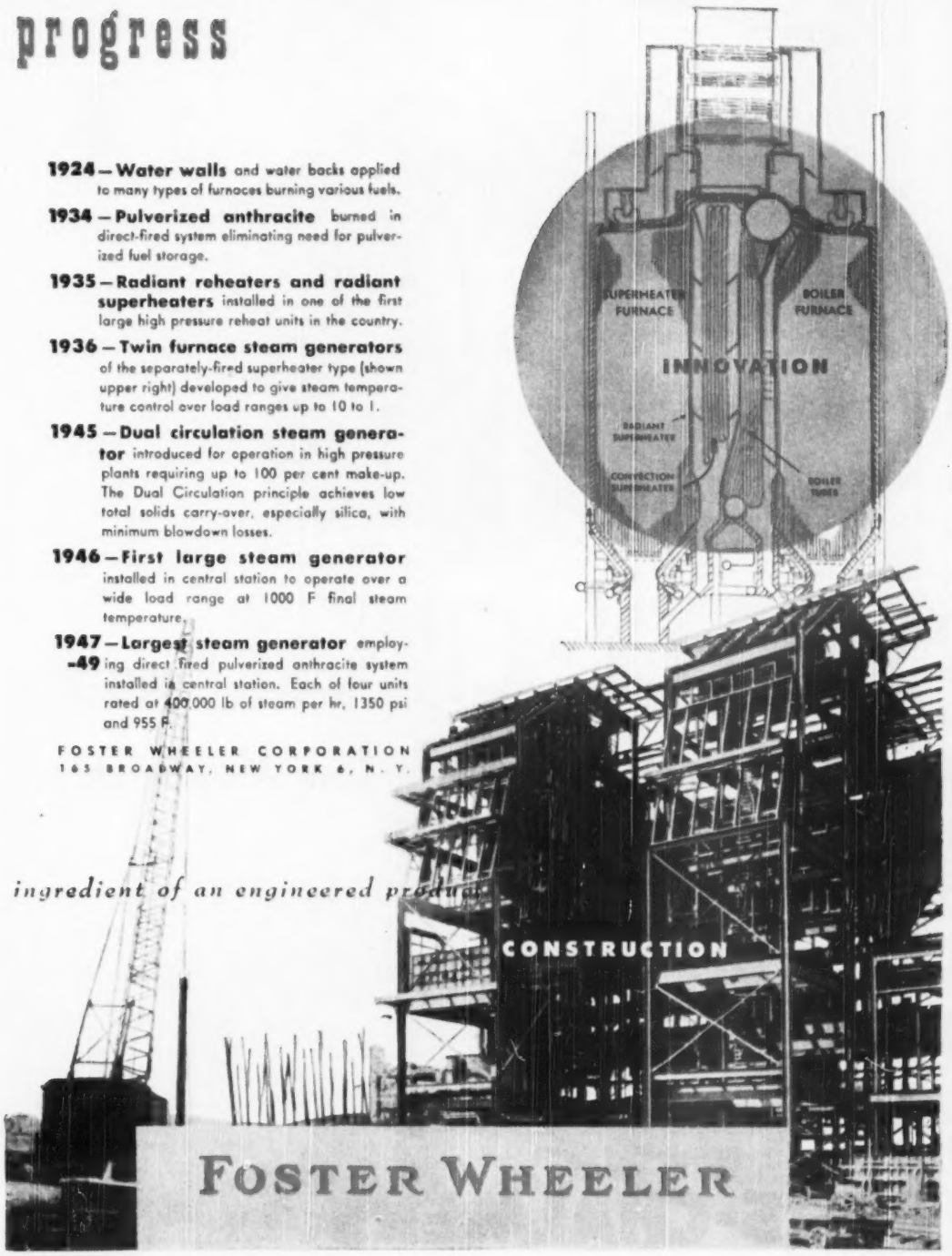
1945—Dual circulation steam generator introduced for operation in high pressure plants requiring up to 100 per cent make-up. The Dual Circulation principle achieves low total solids carry-over, especially silica, with minimum blowdown losses.

1946—First large steam generator installed in central station to operate over a wide load range at 1000 F final steam temperature.

1947—Largest steam generator employing direct fired pulverized anthracite system installed in central station. Each of four units rated at 400,000 lb of steam per hr, 1350 psi and 955 F.

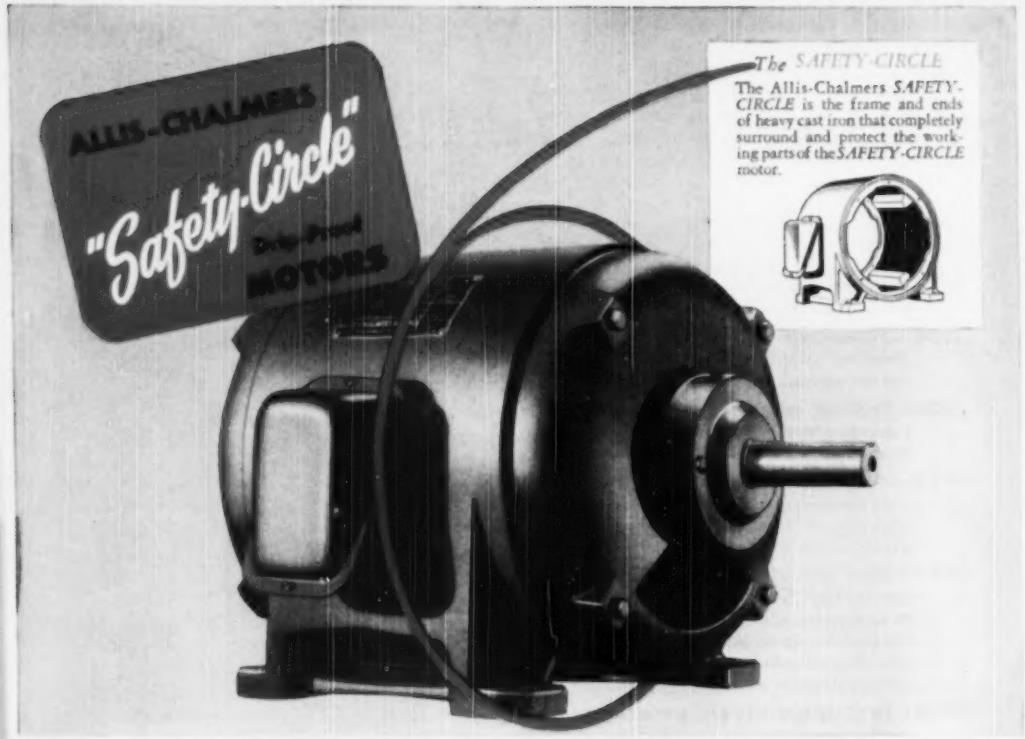
-49

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.



ingredient of an engineered product

FOSTER WHEELER


ALLIS-CHALMERS
"Safety-Circle"
Drip-Proof
MOTORS
The SAFETY-CIRCLE
The Allis-Chalmers SAFETY-CIRCLE is the frame and ends of heavy cast iron that completely surround and protect the working parts of the SAFETY-CIRCLE motor.

SAFETY-CIRCLE means

★ All-Around Protection ★ Low Maintenance ★ Dependable Performance

A-3144

THE *SAFETY-CIRCLE* MOTOR is protected all around against those four great motor killers — corrosion . . . distortion . . . friction . . . foreign matter. The frame is of cast iron, the most corrosion-resistant material for this purpose.

The strength and stiffness of the cast iron is supplemented by ribbing and bracing to maintain alignment and prevent distortion. Ball bearings are lubricated and sealed at the factory. They require no attention for years. End brackets are drip-proof at no premium.

SAFETY-CIRCLE motors are fully protected inside, too. Multiple-dipped and multiple-baked stator plus extra inter-phase insulation provide extra protection against electrical breakdown.

With *SAFETY-CIRCLE* protection outside and protected working parts inside, you can count on years of trouble-free, low cost power.

For complete details on *SAFETY-CIRCLE* advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Stocked in sizes 1 to 20 hp. *SAFETY-CIRCLE*, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

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MILWAUKEE, WIS.

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FIRST-HAND EXPERIENCE IN THE FIELD

Helps Maintain the HIGH QUALITY of

MIDWEST

PRE-FABRICATED PIPING

Midwest not only has a pipe fabricating organization of exceptional skill . . . it also has a Construction Department which has been erecting all kinds of piping for 50 years.

As a result, our shops get continuous first-hand field reports on the erection of fabricated piping. Our Construction Department constantly keeps us mindful of the importance of accurate alignment, thorough cleaning, careful inspection and testing of all bends, welded subassemblies, etc., before they leave the shops.

This situation has been of immense value in maintaining the high quality of Midwest Piping. The Construction Department also is the source of countless suggestions for improvement in pressure piping. All Midwest customers benefit from the accumulation of these suggestions.

Midwest, with four fabricating plants strategically located, has nationwide experience in satisfying the piping needs of all industries. You will always find it advantageous to use Midwest Pre-Fabricated Piping . . . either when purchased on the basis of materials only or piping completely installed.

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More Business—More Profit—for Contractors

NOCRETE WITHOUT CONCRETE ENCASEMENT

ORANGEBURG Fibre Conduit News

STANDARD WITH CONCRETE ENCASEMENT

VOL. 1 NO. 3 — JUNE 1950

MORE DESIGN ENGINEERS SPECIFY THIS CONDUIT

For One and Two-Duct Jobs—NOCRETE

More contractors than ever appreciate the profit possibilities of NOCRETE for single or double duct runs. For when conditions favor its use, NOCRETE—installed *without* concrete encasement—*saves time, work* and *money*—in such installations as factories, schools, colleges, hospitals, drive-in theaters, power, telephone and other communications systems . . . also service entrances, parkway and suburban lighting, airport lighting and communication.

Easily Tooled on the Job

Orangeburg can be worked right in the field. It is easily tooled and can be sawed to any length. It saves time, makes work lighter for the crew. Contractors save by its use, make better net profit.

57 Years' Record of Success

Orangeburg started in 1893. Its quality and durability are *proved*. Today it is standard practice for public utilities, municipalities and industry to use Orangeburg Fibre Conduit when installing cables underground. Orangeburg is leader and first choice in every city and state.

SO LIGHT A CHILD CAN CARRY IT

Standard 4" weighs only two pounds per foot and even *Nocrete* with its heavier wall weighs but four pounds per foot in the 4" size. Think what this lighter weight means. It means lower transportation and handling costs, speedier installation.

ORANGEBURG'S OUTSTANDING ADVANTAGES

These advantages have met with wide acceptance. Each year finds more and more contractors, design engineers, utilities and municipalities turning to Orangeburg for the permanent and economical installation of electrical services underground.

1. Will not corrode. Lasts indefinitely.
2. Impermeable wall and tight joints prevent corrosive ground waters from entering.
3. Lays faster and at lower cost than any other type of conduit.
4. Low coefficient of friction keeps pulling tensions on cable to minimum.
5. Protects cable sheath from abrasion when pulled in—also from wear during cable movement resulting from alternate expansion and contraction with changing loads.
6. Resists acids, alkalis, salt, grease, oil.
7. Light, easy to handle and tool on the job.
8. Tough, resilient—will not crack or break when properly handled.

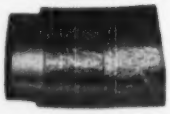
TAPERED SLEEVE JOINTS PREVENT INFILTRATION

. . . of corrosive ground waters. Easily assembled, with Tapered Sleeve Couplings, these joints are permanently watertight.

For Multiple Duct Jobs—STANDARD

ORANGEBURG STANDARD — installed *with* concrete encasement—is the economical construction where duct banks of three or more ducts are involved. In *all* installations, from single to multiple, Orangeburg lays faster, at lower cost, than any other type of conduit.

NOW BRANDED WITH **ORANGEBURG** TRADEMARK



Send for Free Bend Section Folder

Illustrated folder—showing various types of Orangeburg Bend Sections and Angle Couplings—sent FREE on request. Write today to Dept. EW-6, Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, NEW YORK

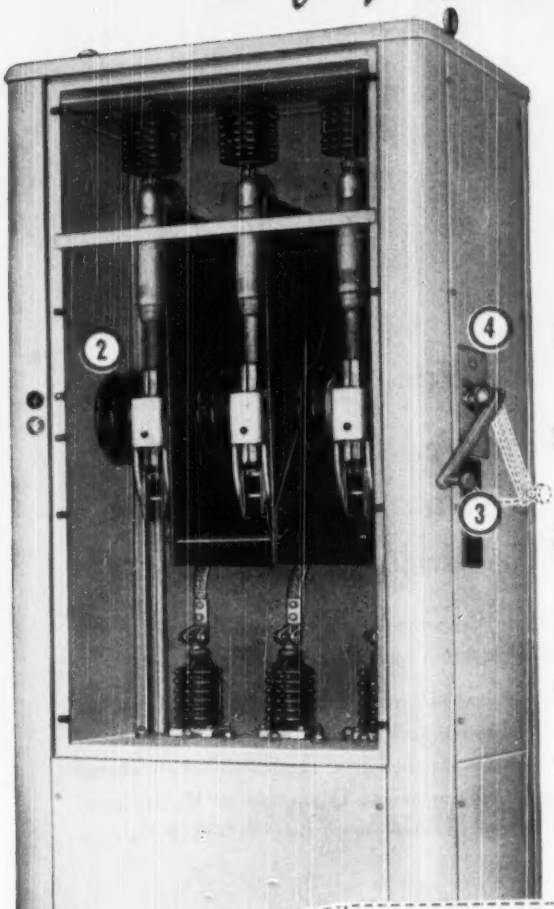
GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

GENERAL ELECTRIC SUPPLY CORPORATION

·ISOLATE TRANSFORMER BANKS

Safely. Economically . . with



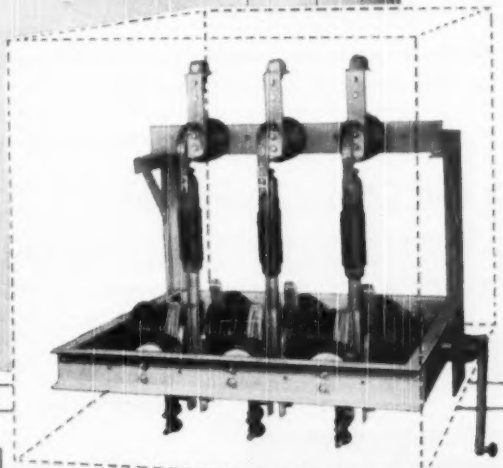
R&IE

INTERRUPTER SWITCHES

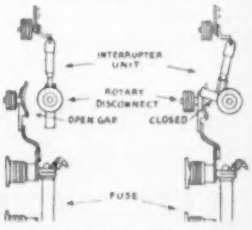
•

Check the Facts

1. Compact, easy to install. Mounts anywhere—on transformers, walls—or free standing.
2. Reliable load interrupter (Plunger type) and rotary switch assembly, single or double throw.
3. Operating handle equipped with sequencing device to prevent opening of switch before it is fully closed. This guarantees proper interrupting operation.
4. Provision for Kirk Key Interlock or Solenoid type system.
5. Housing—standard or custom built (shown left). Key or mechanical door interlocks optional. Frame type for all combinations (single throw unit shown). Fuse or pothead assemblies for any requirement.



Frame type interrupter, below, left, is shown as furnished for application to customers own housing (dotted).



Arcs quenched in interrupter chamber—then rotary switch establishes visible open gap.

I-T-E R&IE

RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.

IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO

AN I-T-E SUBSIDIARY

The Quick Line

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

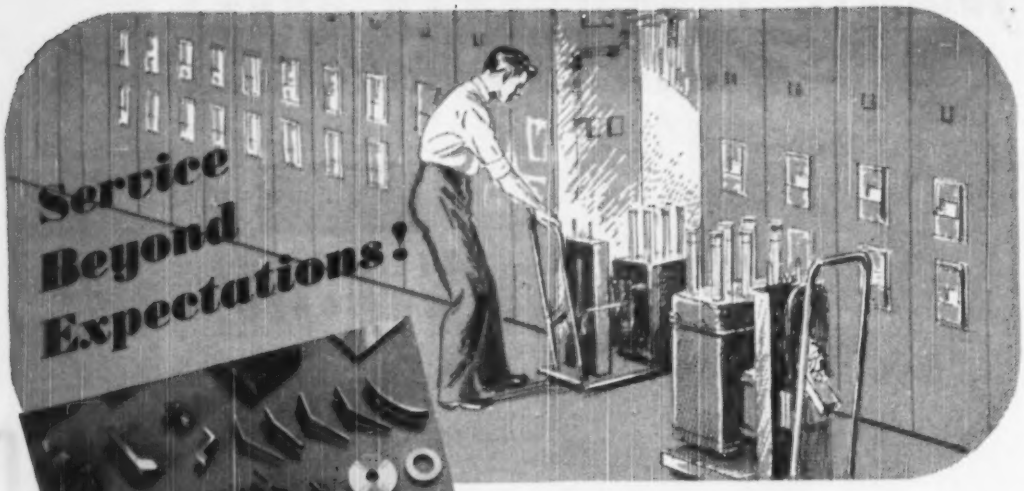
OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

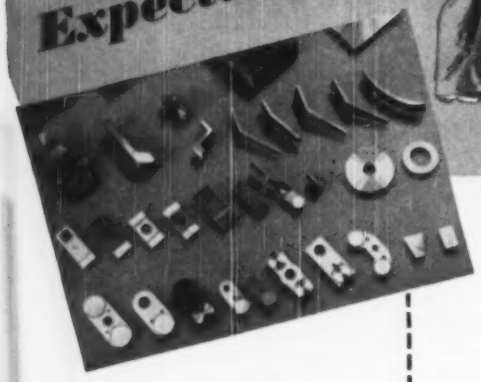
KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES





New Production Methods Reduce Contact Costs For Mallory Customers!

Mallory never ceases the search for new techniques in contact production which can help customers trim costs.

Typical is the case of a manufacturer of industrial type oil-immersed circuit breakers, using Mallory Elkonite contacts. Mallory recently installed new equipment which offered great production economies. This advanced Mallory technique saved the customer more than $4,000 in his next production run.

That's service beyond expectations!

Mallory contact know-how is at your disposal. What Mallory has done for others, can be done for you!

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Elkonite* Contacts

Elkonite is the trade name for a series of contact materials developed by Mallory and manufactured from metal powders. They are best known for their hardness, resistance to mechanical wear and impact, resistance to erosion by arcing, and resistance to sticking.

Elkonite contacts are made by the only method which permits the combining of the desirable features of basic metals which cannot be alloyed. By this means, the high melting points of tungsten, molybdenum, or their carbides, can be combined with the current-carrying ability of silver and copper.

Electrical Contacts and Contact Assemblies

*Reg. U. S. Pat. Off.

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Contacts
Controls	Resistors
Rectifiers	Vibrators
Special Switches	Power Supplies

Resistance Welding Materials

LUBRICATION COST?

...JUST A MIDGET IN A MOB!

That's how lubrication sizes up against the many other production factors which determine your unit costs! Yet, this "midget in a mob" can effect king-size savings for you by raising machine efficiency, cutting friction losses, reducing maintenance expense.

But it takes more than just "drops of oil and dabs of grease" to assure these benefits... it takes men who know your machines and their exact lubrication requirements. Socony-Vacuum provides both the knowledge and the products... through a program of *Correct Lubrication* engineered specifically for *your* plant.

For the *genuine* savings of Correct Lubrication, call your Socony-Vacuum Representative.

SOCONY-VACUUM

GARGOYLE Lubricants

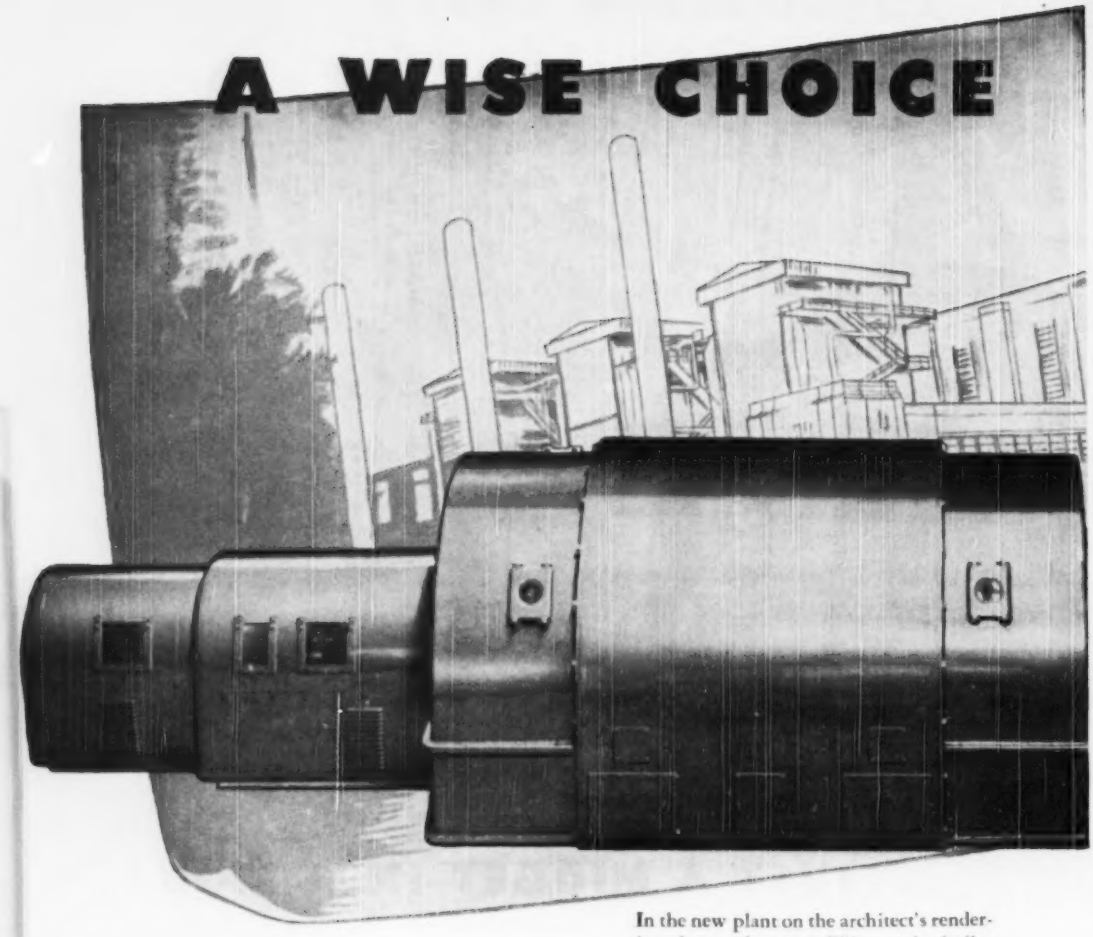
SOCONY-VACUUM

Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

A WISE CHOICE



In the new plant on the architect's rendering shown above, an Elliott unit similar to the one pictured is now in service, with a duplicate unit on order. On the opposite page, the drawing shows another new plant which will house three Elliott turbine-generators — one of 11,500 kw, the other two of 7500 kw each.

ELLIOTT COMPANY

STEAM TURBINE DEPT.
JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

for these fine new plants-

TURBINE-GENERATORS

by ELLIOTT

YOU'LL find them in quite a few of the new medium-sized power generating plants—these sturdy, dependable Elliott turbine-generators.

The unit shown above, rated 11,500 kw, is typical of those which are selected for these stations. Its streamlined design and many superior features of construction in both driver and driven elements express the latest in modern engineering thought. Its reliability is a positive factor assuring not only satisfactory performance, but also a sound basis for close accuracy in the calculation of operating costs.

A new station gets off on the right foot for a long and successful career, when Elliott turbine-generators are selected as its basic equipment.

11-727

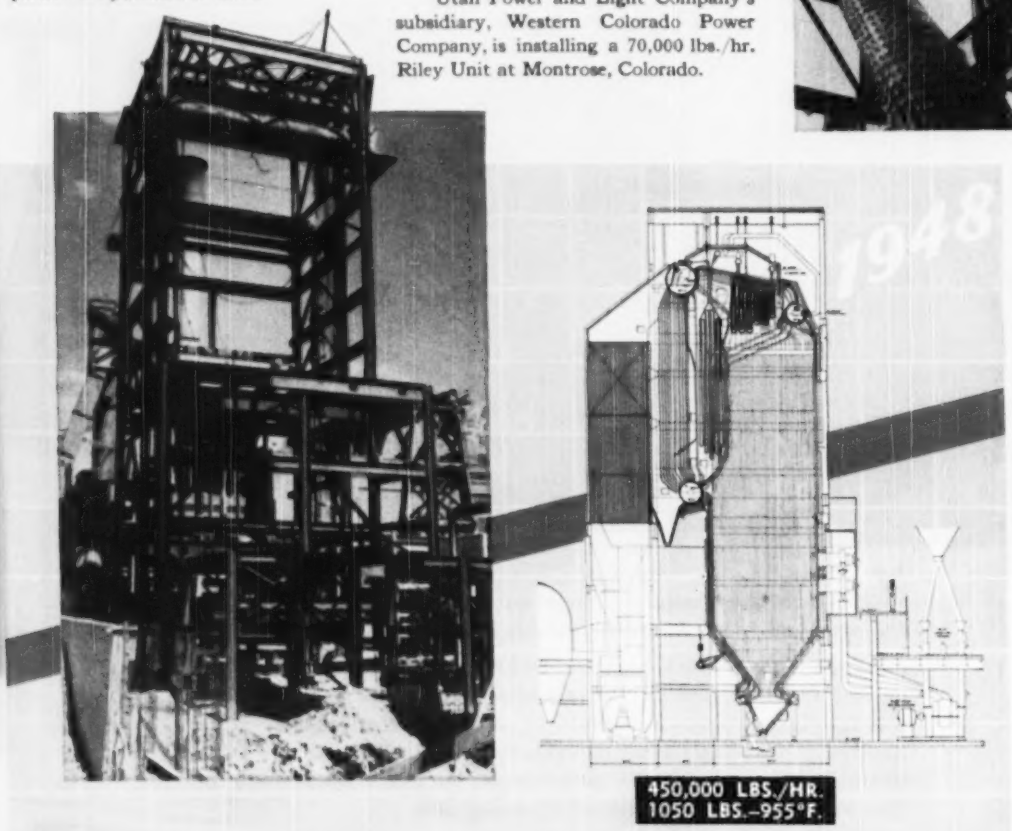
STEAM TURBINES • GAS TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • EXPANDERS • FILTERS

Pattern of Progress at Utah Power

Utah Power and Light Company has instituted a program tremendously increasing its power producing capacity. While their Pattern of Progress includes expansion of many facilities other than their steam power plants, it is an all Riley performance insofar as new steam generating units are concerned.

Utah Power and Light Company installed its first Riley Unit at its Orem Station in 1948—a 450,000 lbs./hr. Riley Unit. Utah Power and Light Company is now installing a 620,000 lbs./hr. 1500 psig 955°F. Riley Unit at its New Jordan Station, and has ordered a 575,000 lbs./hr. 1700 psig 1000°F. reheat Riley Unit to be placed in operation in 1952.

Utah Power and Light Company's subsidiary, Western Colorado Power Company, is installing a 70,000 lbs./hr. Riley Unit at Montrose, Colorado.



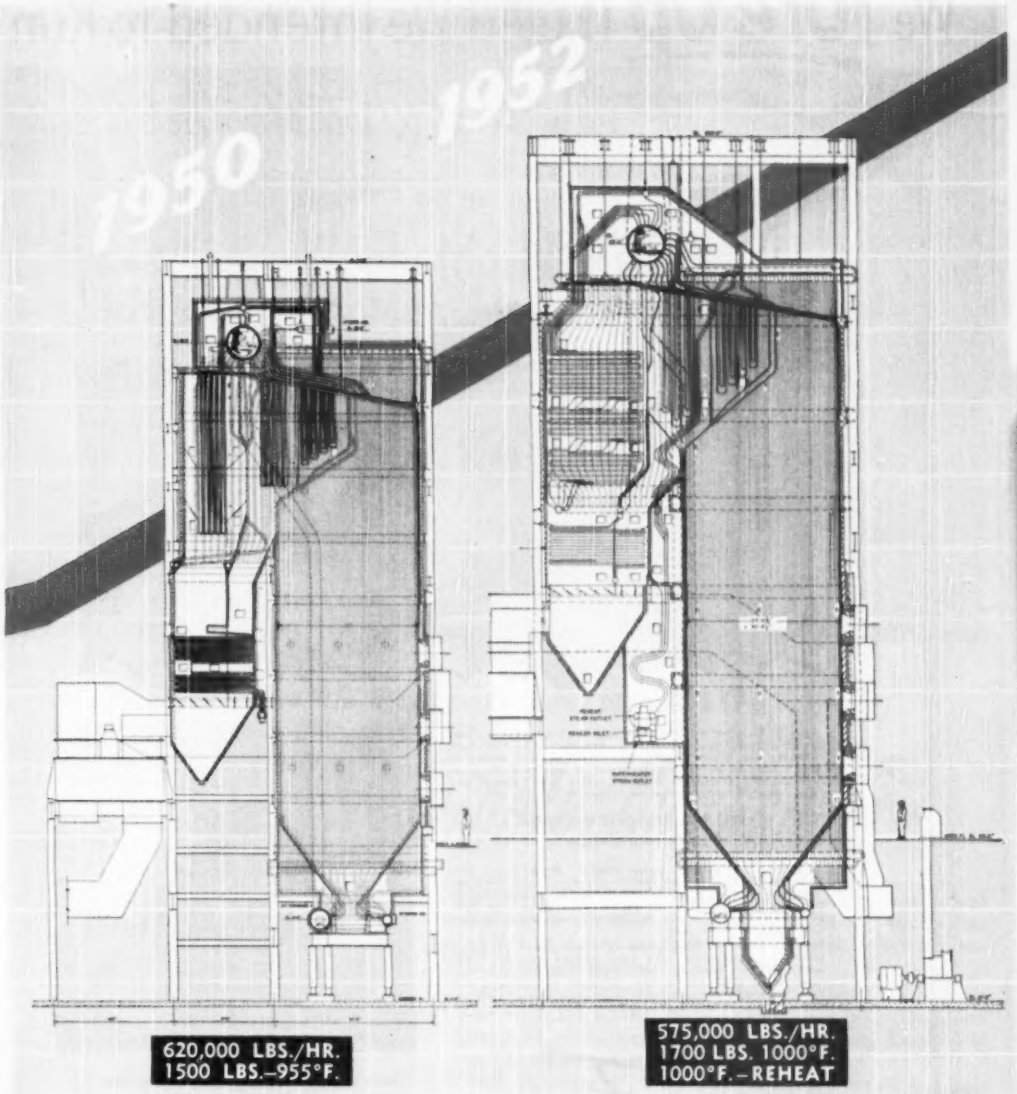
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

& Light - an all RILEY Performance



A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large ... costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS WATER-COOLED FURNACES • STEEL-CLAD ... • AIR HEATERS

We Tore Up The Ad We Intended to Run

And Wrote Another One!

KERRIGAN Lights the Way To a Greater, More Modern Miami!

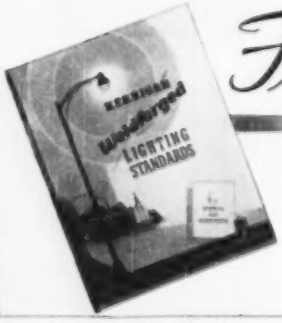
Early in October pictures were made of a brand new street lighting installation in Miami. The standards had been installed on Miami Beach's beautiful Collins Avenue and were ready to be turned on. It was a job we were proud of, and the advertisement shown above was prepared and made ready to send to the magazines.

THEN MIAMI'S WORST HURRICANE SINCE 1926 STRUCK!

Telephone and electric poles toppled; radio towers fell; huge transformers lay smashed in the street, and there was wreckage everywhere. BUT THE KERRIGAN WELDFORGED STANDARDS STOOD. Tall, tapered, beautiful, and PERPENDICULAR—still ready to light the way when the current could be turned on!

The City Engineers were jubilant and wired their congratulations to KERRIGAN. We were jubilant too, but NOT surprised, for Kerrigan Weldforged Lighting Standards meet the highest engineering standards for highway and street lighting. Write today for your free copy of Catalog AIA. It gives detailed specifications.

Photo of Collins Avenue immediately after the hurricane. In the midst of the wreckage, Kerrigan Standards stand like beacons.



Free

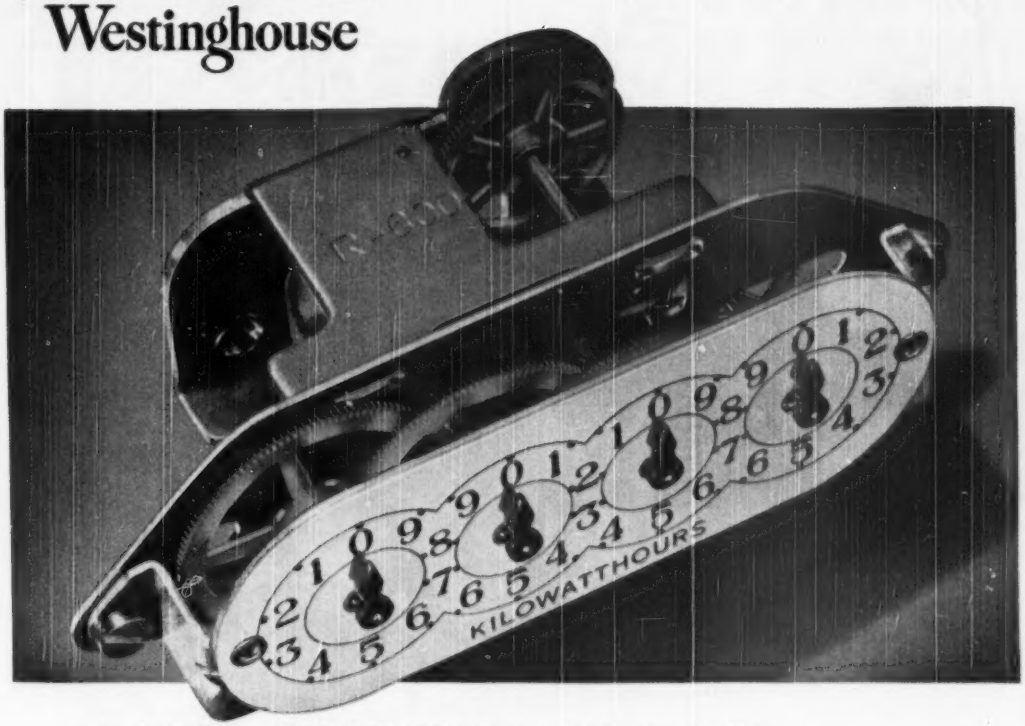
STREET LIGHTING CATALOG

Just send your request (on your letterhead please) to

KERRIGAN IRON WORKS, Inc.
General Sales Office
274 MADISON AVENUE, NEW YORK CITY

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



IT TAKES GEARS PLATED WITH GOLD

TO *Eliminate Corrosion* *

Gold is doubly valuable when it protects meter gears and shafts from corrosion under all atmospheric conditions. Friction is almost negligible for life. Only Westinghouse offers this protection.

And to make doubly sure of low friction . . . involute gear teeth are *milled,* not stamped. They *roll* smooth and free. The gold finish then preserves this fine freedom of motion under all operating conditions.

What's more . . . every precision register is *self-meshing* with the disk shaft, never too tight, never too loose.

Check your meter records. They'll prove that "extras", like gears plated with gold, actually give you the greatest return on your metering investment . . . over a *long period* of years.

Get detailed information . . . ask for the new booklet, "What It Takes for Long-time, Low-cost Metering", B-4665. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40367

Westinghouse METERS

*A VITAL PART OF LONG-TIME, LOW-COST METERING

You can do a *lot*

with a little

GOLD SEAL TAPE

When nothing else will serve, you can count on Gold Seal to stick to the job . . . to produce a longer-lasting bond every time. The reason? Laboratory-controlled production. It assures lasting "tack" in the friction compound.

A tape that will not dry out, peel or ravel not only makes for better taped joints—it *goes further*. You get more joints per *roll* of Gold Seal Tape –more *value*, because there's less waste.

Next time, ask your supplier for Gold Seal. Test it on the job—for grip, for economy. See if you don't agree it's the best buy in tape. Packaged in single rolls and handy 10-roll containers. Each roll cellophane wrapped to keep it *factory-fresh*. Jenkins Bros. (Rubber Division), 100 Park Ave., New York 17, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

JENKINS

Gold Seal Tape

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

Pacific Electric BREAKERS Have

The Features You Want

Outdoor Type JCE-17
14.4 kv, 600 amp
100,000 interrupting kva

Type JCE
Oil Circuit Breakers

JCE-17
14.4 kv—600 amp
100,000 int. kva.

JCE-22
600 and 1200 amp
250,000 int. kva;
23 kv—600 amp
250,000 int. kva

NEMA STANDARDS

Other Pacific Electric Products

Oil Circuit-Breakers from 7.2 kv to 230 kv. Service Restorers 7.2 and 15 kv. Air Break Switches from 7.5 kv to 230 kv. Disconnects from 7.5 to 115 kv. Distribution and Power Fuse Cutouts and Supports. Bus Fittings and Terminals.

Get All Facts . .

1. **Motor-Compressed Closing Springs**—assure positive reclosing from **full-open** position. If control power lost, manual recompression takes but one-half to one minute; normal closing then follows.
2. **Always Full-Energy Closing**—closing power not dependent on system or control voltage—no slow opening or blow-back from sustained fault.
3. **Single-Unit Rotary Contact Structure**—moves as one piece—under no mechanical stress in either open or closed position—easy to inspect.
4. **Simple Interrupter**—a glance shows whether or not it is "in order."
5. **Sliding-Shoe Nested Contacts**—easy to inspect—separate surfaces for arcing and load currents—leaf springs apply nearly constant pressure so require no adjustment during contact life—wiping-action insures clean contact—no sensitive adjustment required to fix closed position—no mechanical stress on bushings at any time.
6. **Trip Free**—mechanically and electrically, in any position.
7. **Control Current No Greater Then Trip Current**—even for high-speed reclosing, the control current is carried by small-sized wires.
8. **3-Shot Reclosing Timer**—mounted in operating-mechanism cabinet—for all usual duties including cut-off of instantaneous attachment after first reclose, if specified.
9. **Full A-c if Desired**—rectifiers not required—a-c control and series trip available with or without relays.
10. **Shipped Assembled**—tested and adjusted at the factory.

Call

PACIFIC ELECTRIC MFG. CORPORATION

5815 THIRD STREET SAN FRANCISCO 24 CALIFORNIA · P. O. BOX 419 GARY, INDIANA

EDGAR F. HUBERT CO. · G. B. KIRKWOOD · J. E. REDMOND SUPPLY CO. · C. C. MUSGROVE · F. W. GORMAN · MARRE & WENDRICH

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Other Representatives in Principal Cities

I-T-E SWITCHGEAR

FOR YOUR OPERATOR AND YOUR PLANT

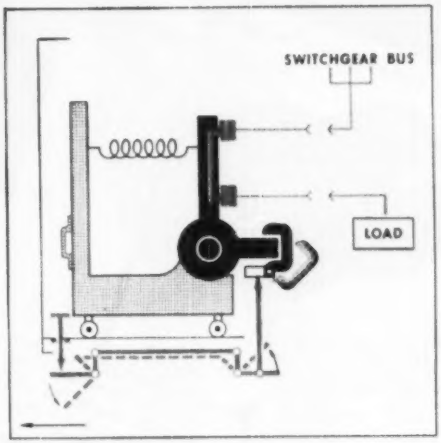
A mechanical interlock is used to assure a sequence of operations. Its purpose is to protect personnel and equipment. For instance, switchgear standards require that drawout circuit breakers be interlocked to prevent being connected to or disconnected from line and load connections unless the circuit breaker contacts are open.

The usual conception of such an interlock works upon the premise that the circuit breaker is held in the closed position by a latch. The latch restrains a force that would otherwise open the circuit breaker contacts. Therefore it should follow that if the latch is disengaged, the released force will cause the circuit breaker to open. However, such an interlock works on "deduction." *If* the latch is disengaged the circuit breaker contacts *should* be separated.

I-T-E's interlock is safer—simpler—more positive than the usual conception. When the contacts are actually separated, and only then, the circuit breaker may be moved.

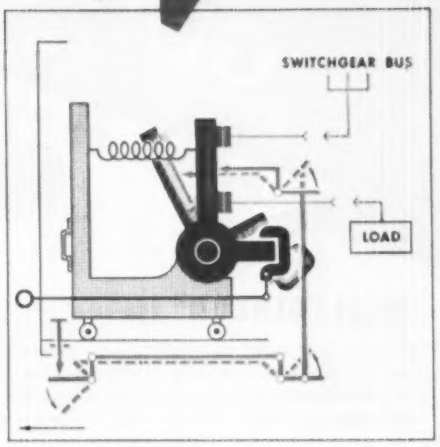
It's simple, yes, but it's important. Your operator's life and your plant's safety may depend on an interlock.

GIVES DOUBLE PROTECTION



THE INTERLOCK BY "DEDUCTION"

A mechanism of linkages must be actuated before force may be applied to move the circuit breaker into or out of engagement with line and load connections. Movement of the interlock disengages the latch, and the circuit breaker contacts *should* now be opened. Because the interlock has been depressed, the circuit breaker may now be moved in or out, whether or not the contacts actually have opened!



THE INTERLOCK BY I-T-E

The positive I-T-E interlock assures that the circuit breaker contacts actually have opened before it is possible to move the circuit breaker. The interlock mechanism is connected directly to the operating arm which carries the movable contacts. Unless the circuit breaker has been fully opened by a separate manual tripping action, the interlock mechanism is not free to move and the circuit breaker cannot be moved into or out of engagement with line and load connections.

Another reason I-T-E is your best switchgear buy!

For more information about I-T-E Multumite Switchgear, send for bulletins 6003-D and 7000-A

I-T-E

For *more dependable* Switchgear

specify I-T-E

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

R&IE

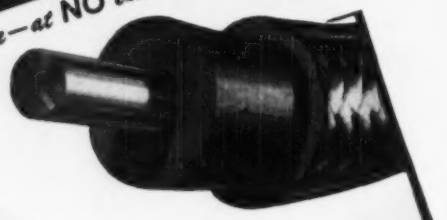
SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • METAL-CLAD • RECTIFIERS • REACTORS • SPECIAL PRODUCTS

At last

BUILDING WIRE THAT LASTS LONGER, PULLS EASIER, SAVES MONEY

...Thanks to TRIANGLE'S new braid of GLAZON

For EXTRA value—at NO extra cost—Insist on "GLAZON"



What "GLAZON" is:

"Glazon" is a tougher, more flexible, longer-lasting braid that combines the desirable properties of an inorganic substance derived from glass with those of special saturants to achieve a new high in safety and durability under the most adverse conditions. This new protective covering gives:

LONGER LIFE. Conductors and insulation are doubly protected by a stronger, tougher, more impervious and more durable covering than heretofore possible.

SMALLER DIAMETER. Braid, although stronger, is considerably thinner. Strands lie flatter, clasp insulation tighter, absorb less saturant—reducing diameter.

GREATER FLEXIBILITY. Less bulk and greater elasticity of the braid increase flexibility.

SMOOTHER SURFACE. Uniformity of fiber and tighter lays eliminate the uneven surface common to many braided coverings.

GREATER RESISTANCE to the destructive elements of man and nature: water, heat, oil, acid, corrosive fumes, fungus, rodents, sunlight, freezing, rotting.

IMPROVED FISHABILITY. "Glazon" covered wire can be snaked through longer conduits, around sharper bends, easier, quicker, than any other type.

EVEN SURFACE, free from bumps and ridges, slides easier.

SMALLER DIAMETER saves space, makes it twice as easy to snake in "that last one."

SMOOTH FINISH prevents sticking, reduces friction on long runs and around sharp bends.

TOUGH COVERING resists impact and abrasion.

GREATER FLEXIBILITY saves time in wiring every junction box, switch box, outlet box.

Costs No More—Yet Saves At Every Step of the Wiring Job

Available in sizes from No. 14 through No. 6 AWG with solid or stranded conductor.

Types R, RH, RW.

If It's "GLAZON" It's Made by TRIANGLE . . .
If It's Made by TRIANGLE It MUST BE Right!

For full information, contact your nearest Triangle distributor or representative, or write

TRIANGLE CONDUIT & CABLE CO., INC.

1900 JERSEY AVENUE • NEW BRUNSWICK, NEW JERSEY

IT MUST BE RIGHT!

"GLAZON" BUILDING WIRE • BARE WIRE • ARMORED CABLE • GLAZON NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES • RIGID CONDUIT HOT-DIPPED GALVANIZED • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

They go together

Nicopress TOOLS
Nicopress SLEEVES

Together they make the Perfect Splice

The National Telephone Supply Company

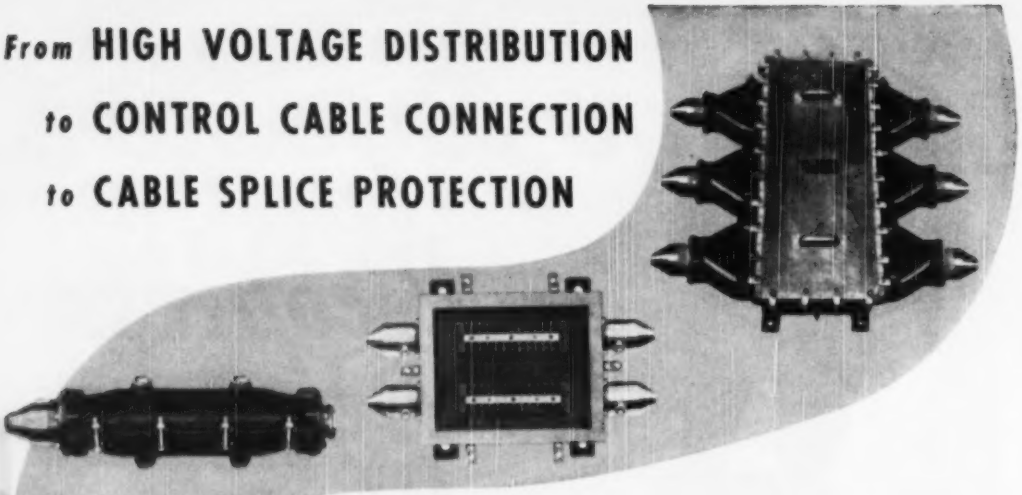
5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

Nicopress is the Registered Trade Mark of The National Telephone Supply Company

From HIGH VOLTAGE DISTRIBUTION to CONTROL CABLE CONNECTION to CABLE SPLICE PROTECTION



G & W can fill your Cable Box needs

The cable box, most versatile of all sectionalizing devices, can be adapted to almost any circuit arrangement. Fuses, links, or direct connection may be used—whichever best fits the job.

G & W oil filled and air filled cable boxes are made in many styles, sizes, and ratings to fill most distribution requirements. Each box is constructed to provide permanent trouble-free service.

- ¼" welded steel construction for safety and dependability.
- Unit interchangeable cableheads for maximum versatility.
- Complete air, oil, and water tight for any installation.
- Covers attached with easily removable "C" clamps.

STANDARD TYPES OF G & W CABLE BOXES INCLUDE:

Air Filled

TYPE WH—5000 volts with disconnecting links—two to eight way—copper busses on porcelain supports—unit sealed cableheads.

TYPE WA—600 volts with links—250 volts with fuses—250 and 500 amperes—two to eight way—construction similar to Type WH.

TYPE G—Multiple circuit direct interconnection—600, 5000, and 7500 volts in three to nine way—solderless clamp lugs for direct connection of cable conductors to busses.

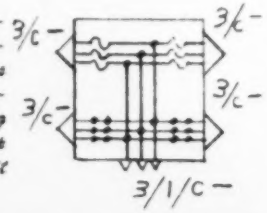
TYPE F—Fused or linked for low voltage distribution—250 volts—250 amperes—to nine ways—contacts and busses mounted on insulating panel.

TYPE X—250 volts—for control cables—wiping sleeve or stuffing box cable entrances—molded terminal blocks.

Oil Filled

TYPE OL—15,000 volts—oil filled for safety and minimum size—sealed unit capnut terminal potheads—with disconnecting links.

Write us or our engineering representative for specific information on boxes for your distribution system. A sketch indicating your requirements will help us determine the best unit for your job.



G&W ELECTRIC SPECIALTIES

G & W ELECTRIC SPECIALTY COMPANY

7780 DANTE AVENUE • CHICAGO 19, ILLINOIS, U.S.A.

Representatives in principal cities — In Canada, Powerlite Devices, Ltd., Toronto

Simplex ANHYDREX CABLES

NEED NO PROTECTION from MOISTURE

Cables installed underground are exposed to moisture to a greater or lesser degree. This moisture can cause serious trouble to your cables and embarrassing interruptions in your service.

Simplex Anhydrex-insulated, neoprene-jacketed cables are designed to be installed underground in ducts or buried directly in the earth. Exposure to moisture, even permanent submersion in water, does not require a lead sheath. The low water absorption and high electrical stability of Anhydrex insulation has been proven by years of service.

Simplex-ANHYDREX Cables have been in service for more than fifteen years. In that time NO SIMPLEX-ANHYDREX CABLE HAS EVER FAILED FROM WATER ABSORPTION. Why trust your distribution lines to an insulation that may be less dependable?

Our extensive experience with low water absorption insulations over the years is at your service whenever moisture creates a cable problem.

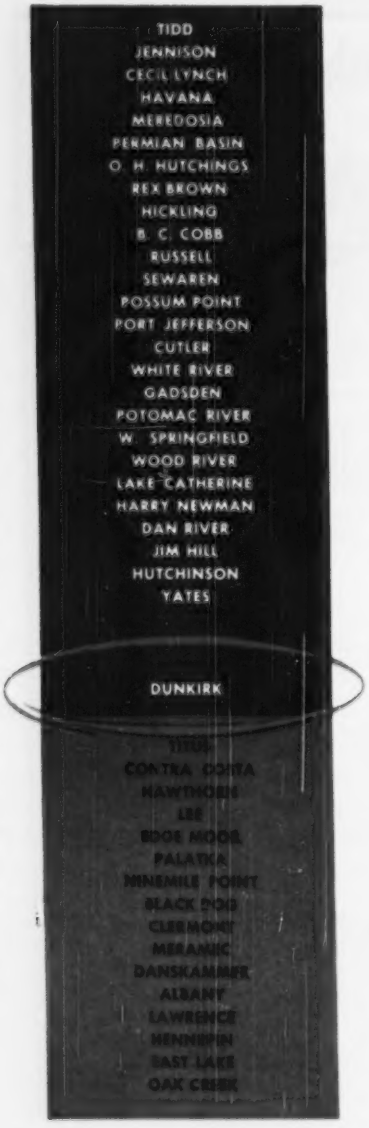
Simplex Catalog 1013 describes and illustrates cables insulated with Simplex-Anhydrex SA insulation. Want one?

SIMPLEX WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.



NEW

New York State, and particularly that area served by the Niagara Mohawk Power Corporation, has experienced an unprecedented postwar demand for electric power. Farsighted planning by the utility company, however, has anticipated needs by providing greatly expanded facilities, notable among which is the new Dunkirk Steam Station recently placed in service.

Strategically located on Dunkirk harbor at the extreme western end of the system, this fine modern power station will shortly make available 160,000 kw of new electrical capacity for New York State.

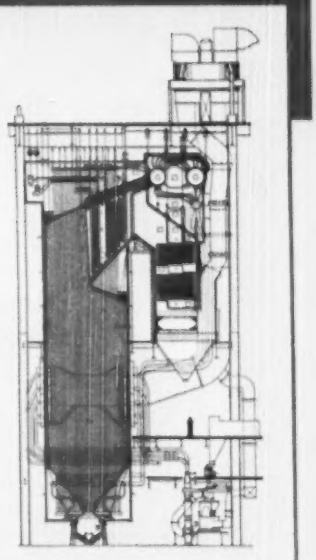
The first of the two 80,000 kw turbine generators was placed in service in October, and the second was ready for operation a month later. Both are of the reheat type, and each is served by a C-E Steam Generating Unit, the equipment having been designed to function in the popular one-boiler, one-turbine arrangement. Niagara Mohawk was one of the earliest companies to use this arrangement on the large units at its Oswego Plant in 1941.

A cross-sectional elevation of one of the C-E Units now operating at Dunkirk, together with a brief description thereof is given on the opposite page. B-446

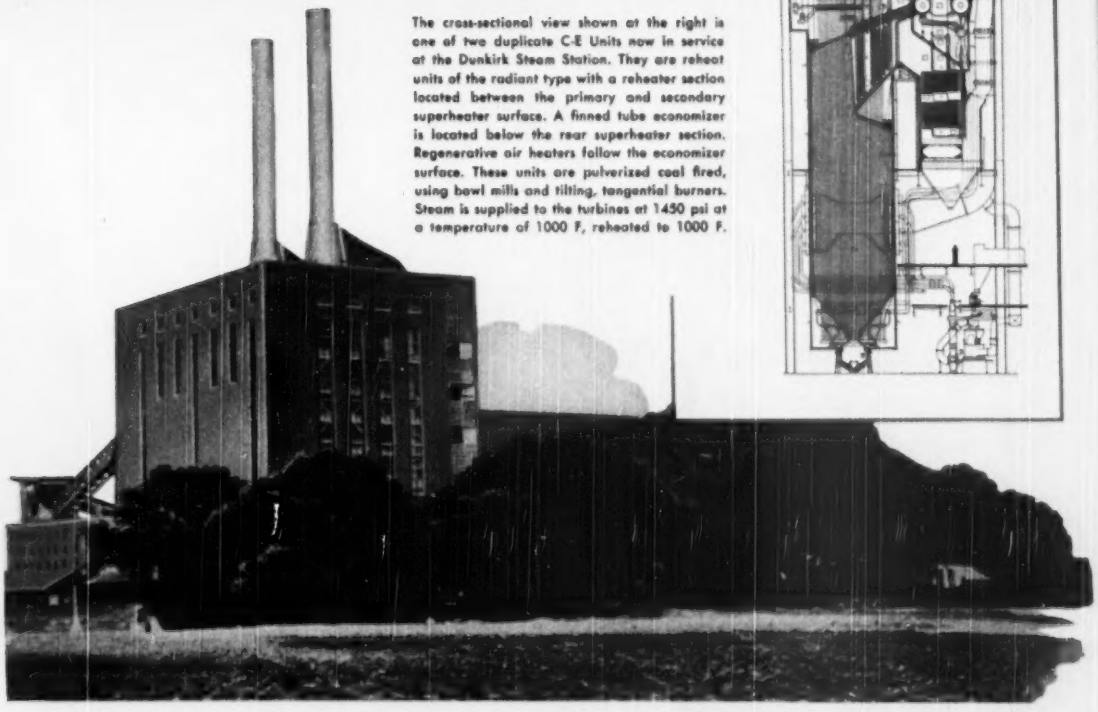
COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS. ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Dunkirk Steam Station goes into service



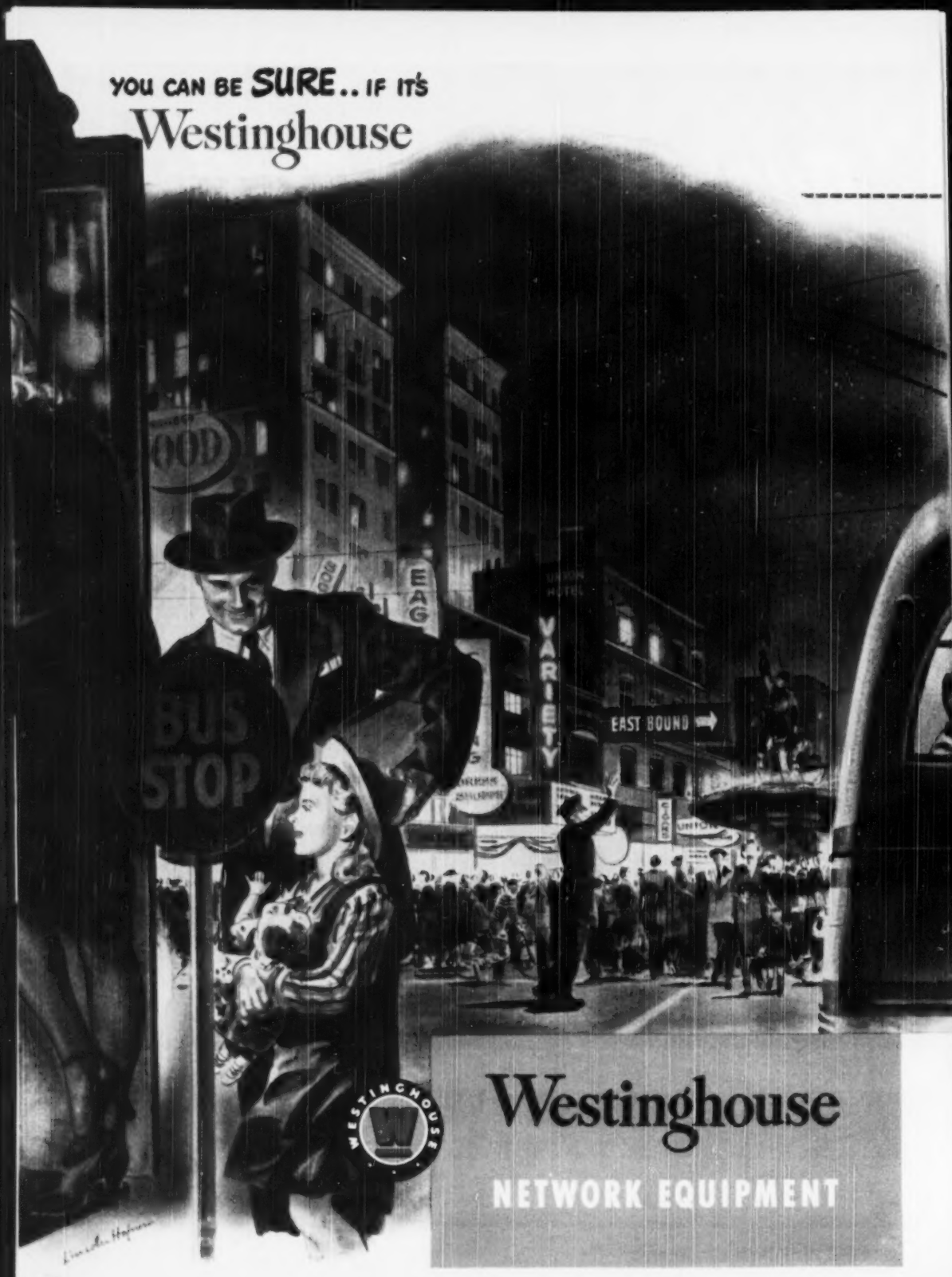
The cross-sectional view shown at the right is one of two duplicate C-E Units now in service at the Dunkirk Steam Station. They are reheat units of the radiant type with a reheater section located between the primary and secondary superheater surface. A finned tube economizer is located below the rear superheater section. Regenerative air heaters follow the economizer surface. These units are pulverized coal fired, using bowl mills and tilting, tangential burners. Steam is supplied to the turbines at 1450 psi at a temperature of 1000 F, reheated to 1000 F.



— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E


YOU CAN BE SURE.. IF IT'S
Westinghouse
BUS STOP
VARIETY
EAST BOUND
WESTINGHOUSE
Westinghouse
NETWORK EQUIPMENT

NOW is the time...
SECONDARY NETWORKS PAY!

Sixty-four per cent of the cities in the 100,000 to 250,000 population range enjoy the dependability and flexibility of secondary network systems! In larger cities the figure is 95 per cent! This is overwhelming proof of acceptance... and it is evidence of widespread action on this basic premise:

Growing loads can be handled most economically by switching to a secondary network system now!

Yes, the sooner you make the switch, the better, for never again will you have an opportunity to make the changeover as cheaply as you can *today!* You'll have less investment in stopgap equipment... a less expensive revamping job...a head start in secondary network savings.

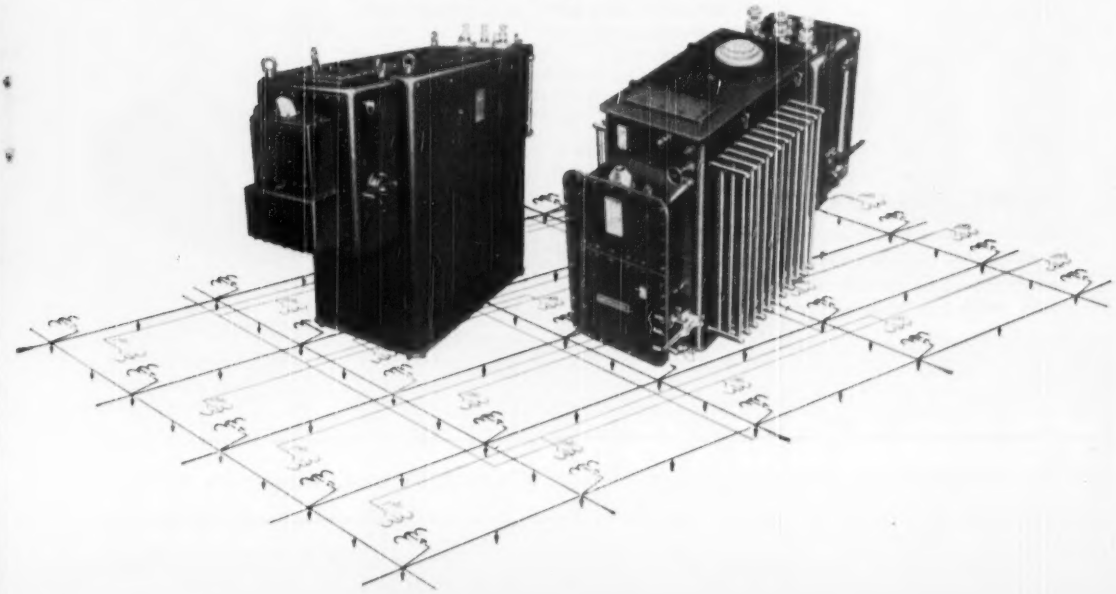
For medium-sized cities, secondary networks provide so high a degree of flexibility that load forecasting is no longer a major concern. Extensions, load shifts and load growth can be accommodated economically... layouts simplified... less and better co-ordinated equipment used. Operating costs go down... revenues and profits up!

As you plan your secondary network, look to Westinghouse for the equipment you'll need. Our complete, correlated line of network equipment includes the right transformers and protectors for all types of load areas.

Booklet B-4002, "A-C Secondary Network Systems", contains complete information. And remember... our complete facilities, engineers and calculating boards are available to help you with your network planning. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-97144

Westinghouse Standardized Network Transformers... from liquid-filled units to submersible dry-type units ...match any degree of underground or overhead service.



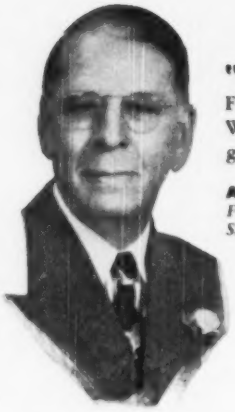
Here's Proof...from utility executives

"Modern street lighting is saving lives in the area we serve."

KINSEY M. ROBINSON, *President*
Washington Water Power Company
Spokane, Washington

"Deaths dropped from 12 to 1 the year after we installed new, up-to-date lighting on a 3-mile stretch of highway."

GEORGE M. GADSBY,
President and General Manager
Utah Power and Light Company
Salt Lake City, Utah



"Street Lighting in a Florida town is an investment. We, as a utility, believe it's good business, too."

A. W. HIGGINS, *former President*
Florida Power Corporation
St. Petersburg, Florida

"Business picks up when street lights go up. Once retail merchants discover this, they're solid boosters for better lighting."

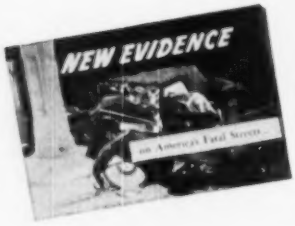
DEAN H. MITCHELL, *President*
Northern Indiana Public Service Company
Hammond, Indiana

"Good street lights make better home towns... it makes the citizens of a town take more pride in themselves and their community."

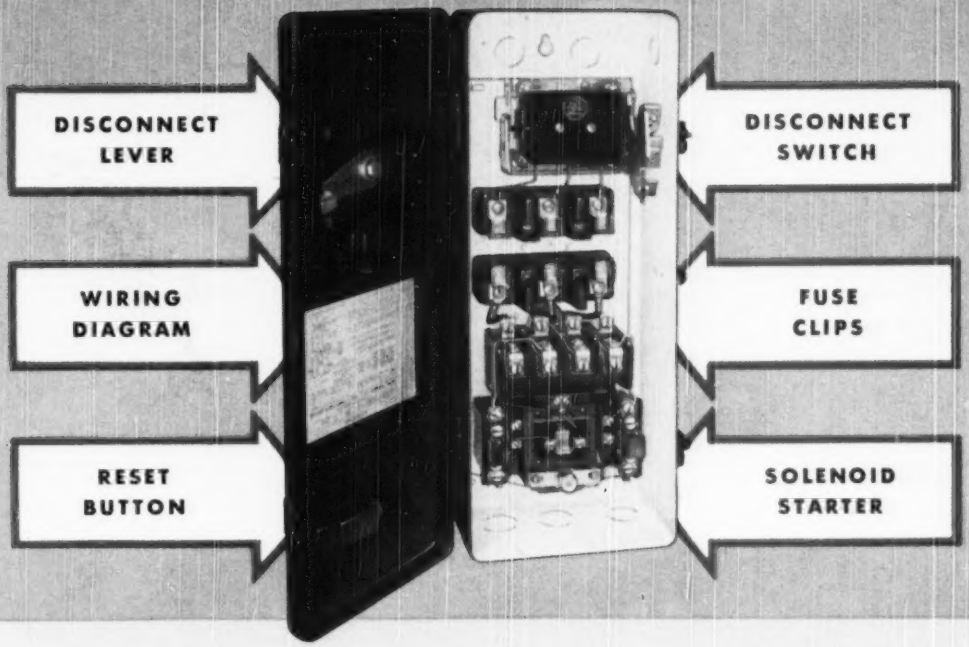
C. B. McMANUS, *President*
Georgia Power Company
Atlanta, Georgia

FOR MORE FACTS...

Write for "New Evidence on America's Fatal Streets." Single copy free—additional copies available to utilities at 10¢ each. Mailed in bulk or per your list.



The Street and Traffic Safety Lighting Bureau, 155 East 44th St., New York 17, N. Y.



Where Wiring Space Is "TIGHT"

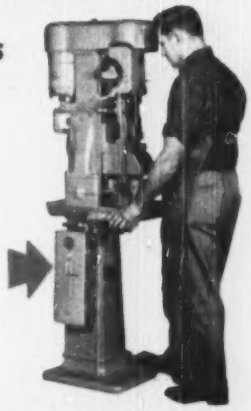
. . . use Bulletin 712 Combination Starters

Starter with lever locked in OFF position with three padlocks for safety to workmen.

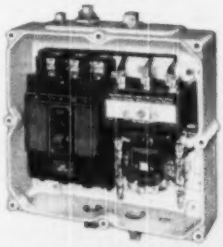
Compactness . . . that is a requirement of modern motor control. Do away with the old style disconnect switches and starters hanging all over your machines and factory interiors. Simplify your wiring jobs . . . make neater installations . . . with A-B combination starters that have all units—disconnect switch, fuses, and motor starter—in a single cabinet. There is greater safety, too. The interlocked disconnect lever must be in 'OFF position to open cabinet. Starter is then "dead."

Send for Bulletin 712-713 on A-B combination starters —with fused or nonfused disconnect switches, or with circuit breakers.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.



Kingsbury drilling and countersinking machine equipped with A-B combination starter.



Bulletin 713 combination starter with circuit breaker in watertight enclosure.

750-M

ALLEN-BRADLEY
COMBINATION STARTERS
QUALITY

BULLETIN 709 SOLENOID STARTERS

Why are they so tremendously popular?

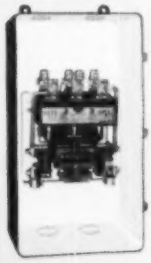
The new Allen-Bradley Bulletin 709 Size 6 and Size 7 solenoid starter. Enclosed arc hood.

Reason No. 1—SIMPLICITY. No pins, no pivots, no knife edges, no bearings, no linkages . . . no trouble making parts to slow up or interfere with uniformity of switch operation.

Reason No. 2—MAINTENANCE FREE CONTACTS. Double break, silver alloy contacts need no filing or cleaning. Parallel contacts open and close at same time, assuring longer contact life.

Reason No. 3—COMPLETE RANGE OF SIZES. Only Allen-Bradley offers a complete line of solenoid starters from Size 0 (15 amp) to Size 7 (900 amp). All have double break, silver alloy contacts.

Reason No. 4—ALL TYPES OF ENCLOSURES. The various types of Allen-Bradley enclosures afford proper protection for operators and starters under all industrial and atmospheric conditions.



Allen-Bradley Bulletin 709 solenoid starters—Size 0 through Size 5. Note the white interiors.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

SOLENOID STARTERS

QUALITY

750-M

"Marshalling the forces of advertising to help solve national problems and to make democracy work better . . ."

DO YOU KNOW that the forces of advertising are engaged today in one of the world's greatest jobs of mass education . . . *in the public interest?*

Do you know that these forces for good have been released through the vision and unselfish cooperation of American business – advertisers, advertising agencies, media owners and others?

Hundreds of advertising agencies have volunteered their planning and creative time and facilities. Artists, cartoonists, photo-engravers, printers, typographers and others have contributed their services.

Media owners have donated millions of dollars in space and time. National and local advertisers have sponsored and paid for many millions of public service advertising messages.

As a result, the American people are being alerted as never before to the dangers which threaten from within and from without . . . the dangers of ignorance about our American economic system, intolerance, tuberculosis, school and teacher shortages, etc.

And, at the hub of this great public service effort is *your* organization . . . The Advertising Council.

Advertisers and Media Owners . . . Your Help is Needed!

Right now The Advertising Council has 14 programs in operation. The success of these programs depends on the public spirited and generous cooperation of advertisers and media owners. *Your* help, in the form of space or time donations, will mean a lot to us. And remember . . . *What helps America helps you!*

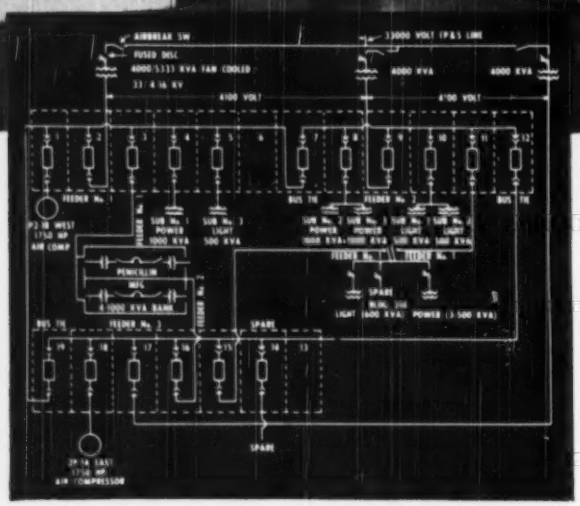
Yours for the Asking

Write for a copy of Booklet No. 15. It will give you pertinent information about The Advertising Council . . . how it started . . . what it is . . . what it does . . .Or ask for material on specific campaigns. Address: – The Advertising Council, 25 West 45th Street, New York 19, N.Y.

Published in the public interest
by
ELECTRICAL WORLD

*A NON-PROFIT ORGANIZATION FORMED TO UTILIZE ADVERTISING IN THE PUBLIC GOOD

Lilly Vital Drug by ALLIS-



Type JM 5 kv switchgear with DZ 100 B oil circuit breakers. Feeds power to complex equipment used in growing penicillin. This equipment includes 125 hp motors, compressors, electrical recording thermometers and timers.

At Eli Lilly's Kentucky Avenue plant, 33 kv is stepped down to 4160 volts through three 4000/5333 kva transformers to three DZ 100 B, 1200 ampere oil circuit breakers with overcurrent relays. Power flows in both directions to a secondary selective system through three 1200 ampere bus tie breakers. From here it is fed to the penicillin area, building 314, substations 1, 2 and 3 and to two 1750 hp air compressors.

Units 6 and 13 are bus tie auxiliaries for emergency use. Breakers protecting the air compressor have thermal, overcurrent and undervoltage relays.

Production Protected

CHALMERS SWITCHGEAR!

"Any power shut down is costly for us," say Eli Lilly and Company engineers. "It's imperative that we maintain *continuous* electrical service to prevent loss of raw materials and rapid deterioration of products in process." Their answer was 5 kv Allis-Chalmers switchgear to assure dependable circuit protection in their Indianapolis plants.

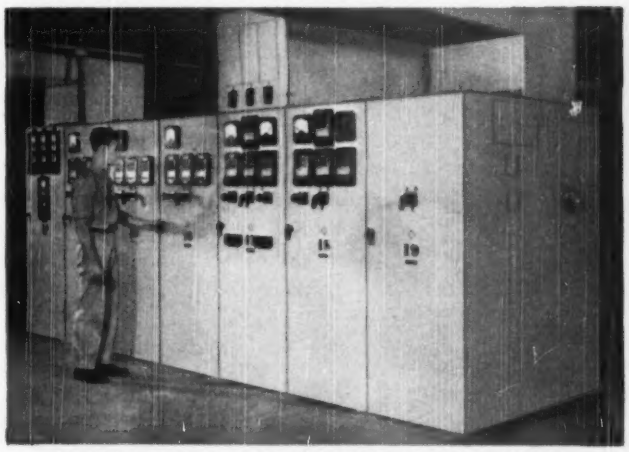
WITH LOSSES LIKE this at stake you can see why Eli Lilly engineers chose Allis-Chalmers switchgear to protect complex filtering, refrigeration, distillation, drying and heating operations.

In streptomycin production, for example, electric power is fed through standard switchgear for every stage of a 72 hour process . . . seeding, growing, fermentation and packaging.

"No maintenance to speak of" that's the A-C high voltage switchgear record at Lilly. 150,000 kva switchgear with *Ruptair* circuit breakers furnishes protection to the McCarty Street plant for liver, insulin and general pharmaceutical production.

At the Kentucky Avenue plant, Allis-Chalmers 250,000 kva, 4160 volt switchgear with oil circuit breakers controls power for production of ampules, antibiotics and general pharmaceuticals.

* * *



5 kv, 1600 ampere switchgear with DZ 100 B oil circuit breakers feeds power to the shipping department and streptomycin section of the Kentucky Avenue plant.

Is *yours* one of the many modern industrial plants that rely on standard Allis-Chalmers switchgear as essential to low cost, continuous plant operation? If not, it will pay you to investigate.

A-C switchgear is flexible. Standard units can be added as your load expands. *It's safe to operate.* Metal-clad construction is dead front for safety to personnel. Interlocks and automatic shutters protect personnel from high voltage parts and make it impossible to move the closed breaker to or from operating position.

Prefabricated, pretested, completely assembled, ready to operate when delivered! Furnished with air blast, oil or *Ruptair* circuit breakers.

See your local Allis-Chalmers sales representative or write for bulletin 71B6129D. A-3129

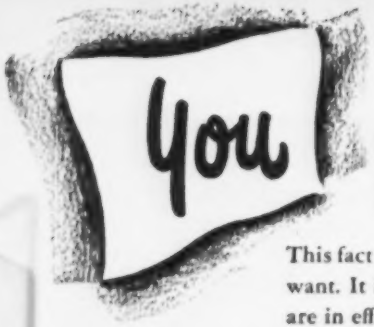
Ruptair is an Allis-Chalmers trademark.

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

First in the U. S. with Metal-Clad Switchgear

there are *no allocations* on

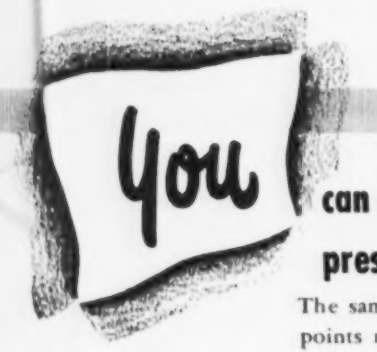


can make new conductor and strand last 3 to 10 times longer . . .

This fact is important enough in times when you can get all the conductor you want. It is doubly important now that allocations of conductor and strand are in effect.

It has been proved time and again, that conductors fail most frequently at support points . . . from vibration, from power arcs, from chafing in the clamps. Even mid-span failures may be caused by vibration and arc-over.

Preformed Armor Rods provide a positive means for reducing these failures to a degree not possible with any other means of conductor protection. They are backed by exhaustive tests in the Country's best equipped physical testing laboratories. They are installed on thousands of lines today. (Laboratory test reports and names of present users are available on request.) They cost far less . . . installed . . . than any other form of conductor protection.



can make splices and repairs at a fraction of your present costs...and save conductor in the bargain

The same tight-gripping action that PLP Armor Rods develop at support points makes them ideal for splices and conductor repairs. Splices made with PLP Armor Rods actually exceed the original conductor in tensile strength and current-carrying capacity.

Preformed Armor Rods are quickly applied. The average installation takes about 3 minutes. No sections of line need be cut out. No high clamping pressures are developed that might damage the underlying conductor. *Any* lineman, regardless of his skill, can make a perfect installation every time. RESULTS ARE PREDICTABLE WITH PLP ARMOR RODS.

armor rods today assure more operating conductor tomorrow

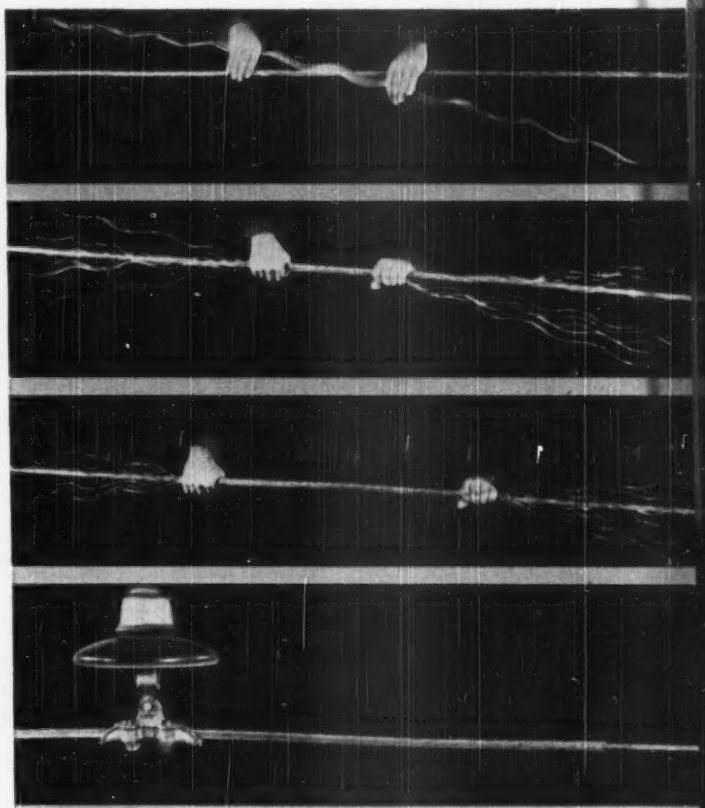
the *conductor you save!*

You can learn the technique of applying PLP Armor Rods in the time it takes to read this

Because PLP Armor Rods are preformed, the only tools you need to apply them are your hands. If you can wring water from a cloth, you have mastered the motion needed. It is as easy as this:—

1. Take half to a full set of rods specified for the conductor you are working on. Place them across the conductor in the same direction as the lay of the conductor.
2. Grip the rods and the conductor in each hand and rotate in opposite directions. Just like wringing water from a cloth.
3. Repeat with the rest of the rods as above.
4. Continue the wiping action with the full set of rods until you have progressed to both ends of the rods. The ends will snap into place. No clips or clamps are needed to secure them.

You could make a perfect installation with what you have just learned. Like to try? We will gladly send you a sample set of PLP Armor Rods to examine thoroughly in your own office. Write on your company letterhead, to:—



PREFORMED

PLP

LINE PRODUCTS CO.

CLEVELAND 14, OHIO

*Preformed Armor Rods are for use under Patent No. 2,275,019 . . . other patents pending.

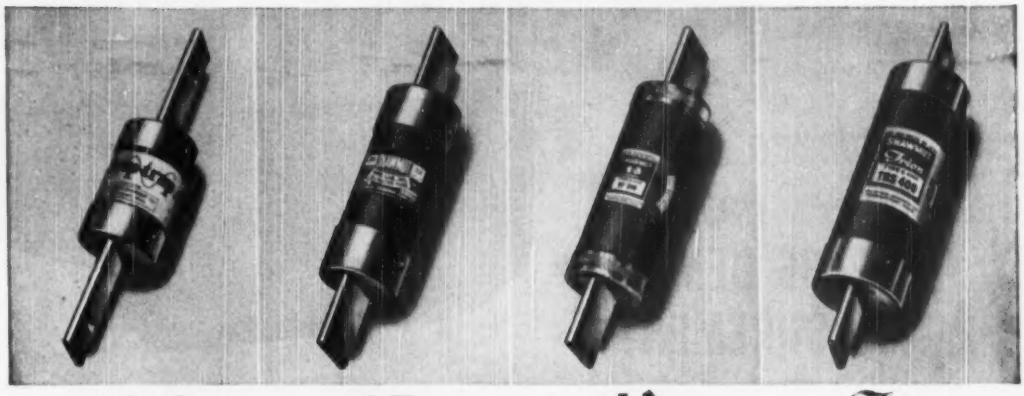
IF YOU HAD TO STACK 'EM ALL IN YOUR OFFICE...

Do you think that your system is one which "doesn't have trouble with high-voltage pin-type insulators?" If so, it might be worth a good many thousands of dollars per year to your company to have you take a real good look at your maintenance records. The number of pin-type insulators which have to be replaced every year—and the man-hours required to replace them—add up to an annual bill probably a great deal larger than you suspect. And it's a bill that could be cut to a tiny fraction of its present size by standardizing on Lapp Line Posts. There's a 19-year service record back of Lapp Line Posts to back up this fact. Isn't it time for *your* company to undertake the high-preformance low-cost Line Post program?

MICRO SECONDS TO HOURS...

DC or AC . . . up to 200,000 amperes interrupting capacity!

Who else or what else can offer this scope of CIRCUIT-MATCHED electrical protection for circuits 600 volts or less?

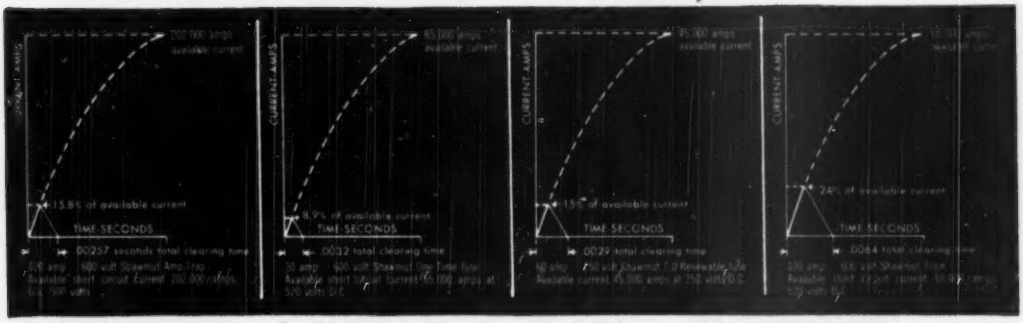


Amp-trap *. . . super fast*

ONE O-T TIME *. . . fast*

Time t-d delay Renewable *. . . time delay*

Trion *. . . super time delay*



Amp-Trap current limiter — 1 to 4000 amps.

Protects: Branch circuits, feeders, cables, bus ducts, against very heavy short circuits up to 200,000 amps interrupting capacity.

SEND FOR AMP-TRAP BULLETIN

One O-T Time — non-renewable — 1 to 600 amps.

Protects: Branch circuits and feeders against overload and moderate short circuits.

SEND FOR BULLETINS 501 and 502.

Time t-d Delay — renewable — 1 to 600 amps.

Protects: Branch circuits and feeders against overload and moderate short circuits. Has built-in time delay on overload.

SEND FOR BULLETIN 500.

Trion — dual element — 1 to 600 amps.

Protects: Branch circuits, feeders and motors against overload, overheating, single phasing and heavy short circuits.

SEND FOR BULLETIN 506.

THE CHASE-SHAWMUT COMPANY
370 Merrimac St., Newburyport, Massachusetts

SHAWMUT Circuit-Matched FUSES

Insure more accurately engineered protection for any circuit

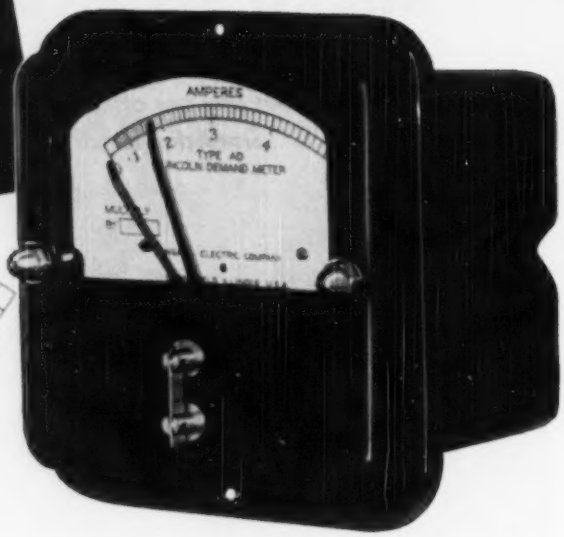
SINCE 1893

The most complete line of circuit protection devices

Amp-trap **Trion** **Time t-d delay** Renewable **C-O-T** **Trionet** **ONE O-T TIME** **FUSE WIRE**

For MAXIMUM RETURN on the Investment in Your Distribution System

Balance Loads on the basis of AMPERE DEMAND MEASUREMENT



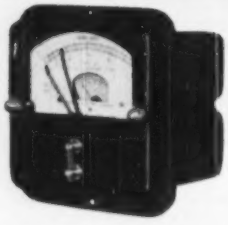
Capacity of distribution circuits depends on the heating effect of the load in amperes. You can get the most out of your distribution system by balancing the load on this basis.

Lincoln Thermal Ampere Demand Meters measure this capacity-determining factor and are particularly useful for the measurement of loading on distribution feeders. Because the indication is highly time-lagged, these meters show the value of the current which remains on the feeders long enough to affect the carrying-capacity of the lines and distribution equipment.

Where instantaneous values of current are important, Lincoln Ampere Demand Meters can be furnished with an indicating ammeter to show immediately whether the load has been picked up after an interruption.

LINCOLN Ampere Demand Meters are available for Indoor and Outdoor Substations

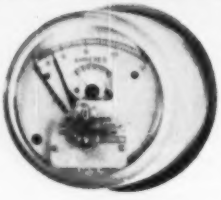
Type AD-2



For Indoor Switchboards . . .

Semi-flush or surface mounting with or without instantaneous indicating ammeter.

Type ADS



For Outdoor Substations . . .

Standard meter-socket mounting with or without instantaneous indicating ammeter.

Type ADN

Special For "Wye" Banks

Standard meter-socket mounting. Type ADN meter has through cable for connection into "Wye" neutral leads, requiring no instrument transformers.

Lincoln Graphic Ampere Demand Meters are also available for indoor or outdoor applications. Full information is given in these bulletins: Bulletin 461 (Type AD-2 and ADS); Bulletin 467 (Type ADN); Bulletins 451 and 452 (Graphic Types).

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

At this holiday season, Southern States Equipment Corporation and SS representatives throughout the nation join in expressing appreciation to our many friends for our pleasant relationship through the years.

We extend our best wishes for a very Merry Christmas, and a prosperous and happy New Year.

LOS ANGELES, CALIF.
Raymond D. Andrews

JACKSONVILLE, FLA.
H. Jack Belcher

VALPARAISO, IND.
Arnold C. Blaese

CHICAGO, ILL.
Engineered Sales, Inc.

KNOXVILLE, TENN.
Claude E. Fox

DENVER, COL.
Franklin Sales Co.

CLOVIS, N. MEX.
A. W. Graham

SILVER SPRINGS, MD.
Ernest Hover

ATLANTA, GA.
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(Factory Office)

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MINNEAPOLIS, MINN.
The Klass Company

KANSAS CITY, MO.
Lake Sales Co.

DALLAS, TEXAS
Roy N. McCowen
(Factory Office

SAN FRANCISCO, CALIF.
Pacific Electra Sales Co.

BETHLEHEM, PA.
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SEATTLE, WASH.
Joseph C. Platt

JACKSON, MICH.
F. W. Pollock Co.

CHARLOTTE, N.C.
Purser & London, Inc.

SALT LAKE CITY, UTAH
H. L. Rawlings

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J. F. Shouse Co.

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C. L. Smith
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BOSTON, MASS.
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A. T. Timmerman

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YOU CAN BE SURE.. IF IT'S
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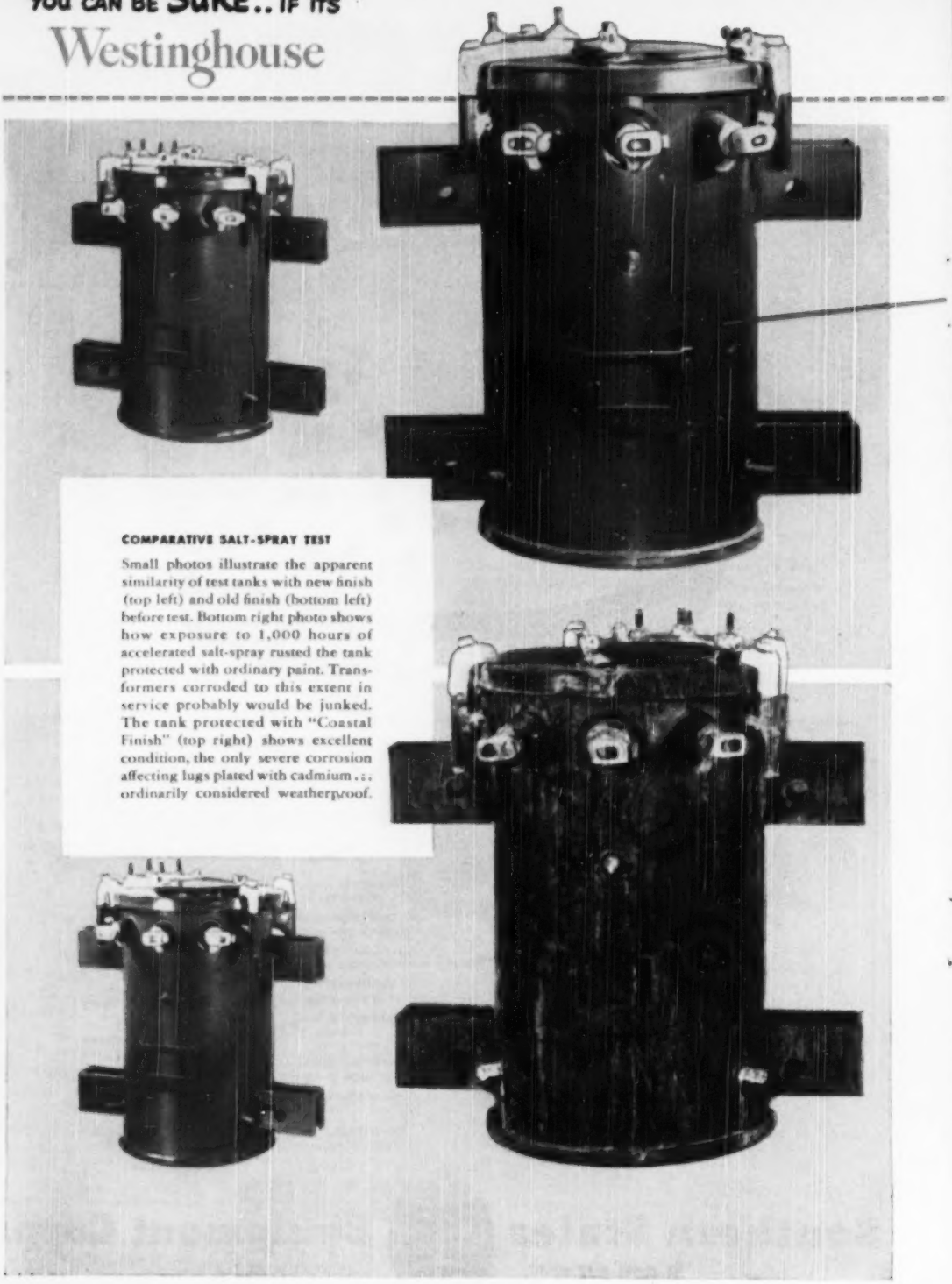

COMPARATIVE SALT-SPRAY TEST

Small photos illustrate the apparent similarity of test tanks with new finish (top left) and old finish (bottom left) before test. Bottom right photo shows how exposure to 1,000 hours of accelerated salt-spray rusted the tank protected with ordinary paint. Transformers corroded to this extent in service probably would be junked. The tank protected with "Coastal Finish" (top right) shows excellent condition, the only severe corrosion affecting lugs plated with cadmium . . . ordinarily considered weatherproof.

—NEW "COASTAL FINISH"

New finish for Pole-Type Transformers adds years of protection under all service conditions

Greater resistance to chalking, cracking and rust! More than doubles the protective life of the finish! Adds years of service before repairing and repainting!

A new and better finish, developed in Westinghouse laboratories specifically to meet severe conditions of blistering heat, icy cold, rain, snow, salt and other corrosive atmospheres, *"Coastal Finish"* is now provided on all Westinghouse Distribution Transformers, "CSP"® and conventional.

"Coastal Finish" consists of a primer coat to inhibit rust, an intermediate coat containing mica flakes that overlap like shingles on a roof to provide superior moisture resistance, and a final gloss coat that improves appearance, and filters out ultra-violet sun rays. Infra-red baking assures complete hardening of each paint film.

Comparative weathering tests . . . salt-spray, acid and alkali resistance, and weather-o-meter . . . clearly show the advantage of *"Coastal Finish"* in all types of atmospheres. This is *another plus value* in Westinghouse Distribution Transformers. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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DISTRIBUTION TRANSFORMERS

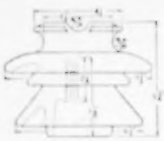
ANOTHER
VICTOR INSULATOR
THAT SAVES
AS IT SERVES

VICTOR

TRANSMISSION PINTYPE INSULATORS

No. 245

BUILT FOR EXTRA LONG LIFE!



No. 127

No. 245

VICTOR Catalog No.		127	245
Nominal Voltage Rating		27	45
60 cycle dry flashover	KV.	95	125
60 cycle wet flashover	KV.	60	80
Dry arcing distance	In.	7	9½
Leakage distance	In.	13	21
Pinhole diameter	In.	1⅜	1⅜
Cantilever strength	Lbs.	2,500	3,000
RNI (plain)	MV.	8,000	16,000
RNI (radio-freed)	MV.	100	200
1000 KC at applied	KV.	15	30

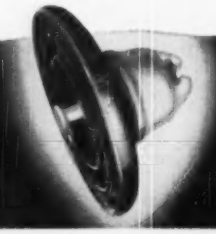
FACTS—*actual performance data* obtained from installations throughout the country—prove that VICTOR transmission pintype insulators *retain* their original high standards after *years and years* of severe service on the job. This means *extra* years of trouble-free insulator service.

The extra service-years you get in *every* VICTOR pintype insulator are a result of such built-in features as: Construction of the *best* high voltage porcelain, a rugged, *self-cleaning* design, and a *special "cushion" coating* at the joining surfaces that *eliminates* problems caused by thermal expansion.

Reap the benefits of long, dependable service—*standardize* on VICTOR transmission pintype insulators.

For more information consult our new Condensed Catalog No. 4, write us, or call your VICTOR representative.

VICTOR
INSULATORS Inc.
VICTOR, NEW YORK



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V

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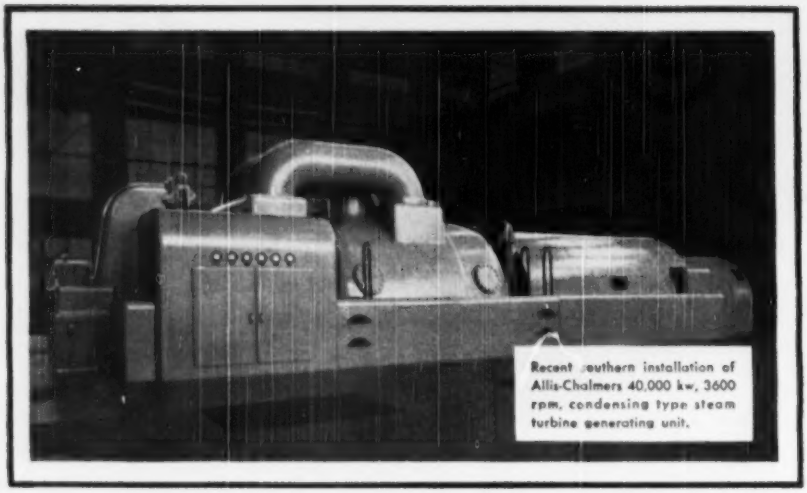
"BUILDERS FOR INDUSTRY"

DESIGN • ENGINEERING • CONSTRUCTION

For Power Today, Industry Relies on

STEAM TURBINE GENERATORS!



Recent southern installation of Allis-Chalmers 40,000 kw, 3600 rpm, condensing type steam turbine generating unit.

SOME CALL THIS THE ATOMIC AGE, but steam is more than ever the prime mover in American industry. Steam, driving the modern steam turbine and generator, now supplies over 70 percent of U. S. electric power!

And every year sees more steam turbines going on the line . . . turbines with design still further perfected, operating more efficiently and for longer periods between shutdowns. At Allis-Chalmers, turbine design is progressive, with advances in materials and know-how immediately being translated into better machines.

As a manufacturer building large central station turbine generator equipment, A-C is an important source of steam turbines in all types and combinations. In the larger ratings, A-C has in service large single shaft condensing units to 150,000 kw and topping turbines to 50,000 kw.

In addition to concentrating on mechanical features, Allis-Chalmers builds steam turbine generators with an eye to functional and attractive appearance (see photo above).

When you plan the installation or expansion of a steam power plant, consider Allis-Chalmers. Put its 80 years of steam power experience to work for you. Offices in all major cities. A-3213

ALLIS-CHALMERS, 932A SO. 70 ST.
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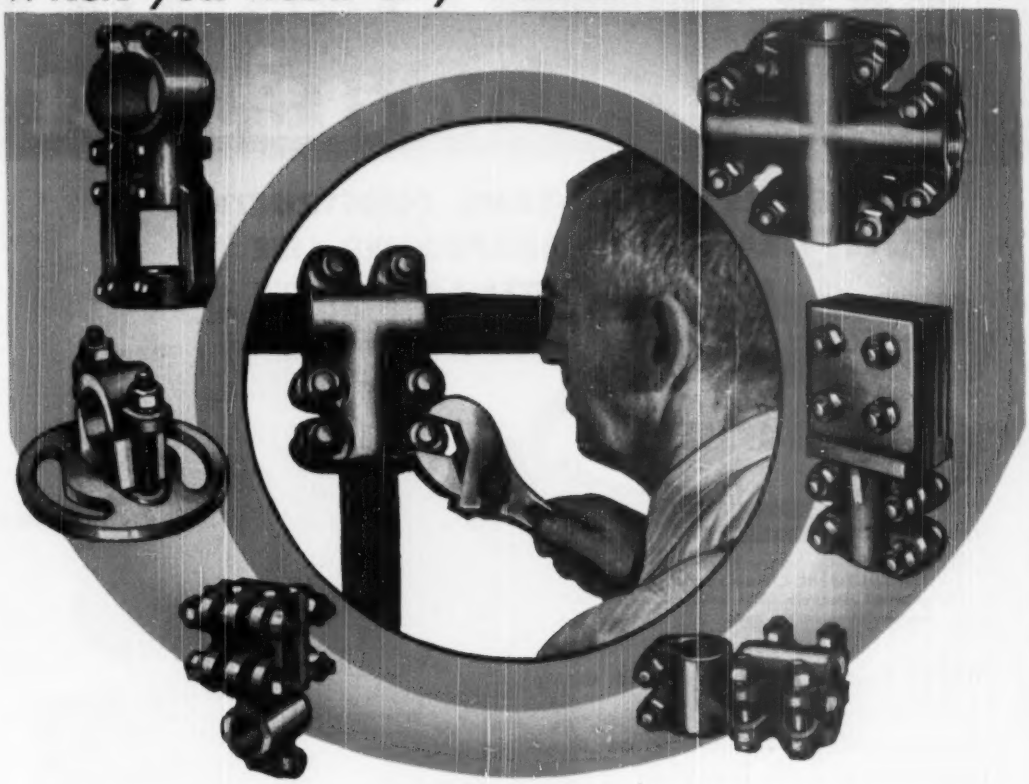
TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANSFORMERS | WATER CONDITIONING

World's Widest Range of Power Plant Equipment

When you need any **POWER CONNECTOR—**



see the Complete *line*

Probably the exact Power Connector you want is one of the standard Penn-Union items. You will find Tee and Stud Connectors and Solderless Terminal Adapters, Bus Supports, Terminals, Elbows, Cross Connectors, Couplers, Reducers—each in a wide range of sizes, up to the largest.

Also the *complete* line of Service Connectors, Cable Taps, Straight and Parallel Connectors, Grounding Clamps—every good type of conductor fitting. Penn-Union connectors are the first choice of experienced users, because of their *known dependability,* mechanically and electrically.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

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THE *Complete* LINE OF CONDUCTOR FITTINGS

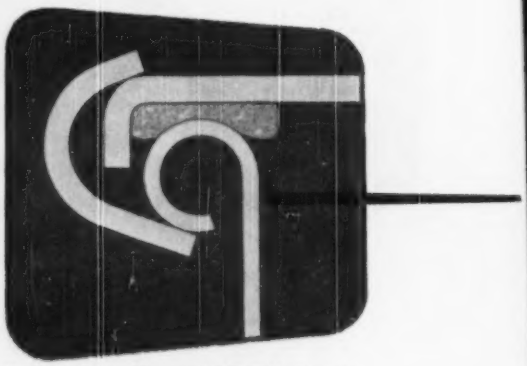
PENN-UNION

NEW Wagner Wagner

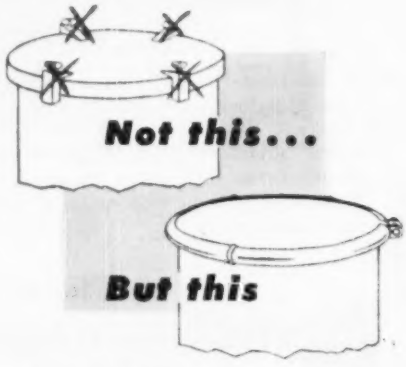
ASSURE SEALED-TANK CONSTRUCTION
LONGER TRANSFORMER LIFE
LOWER MAINTENANCE COSTS

The SHUR-SEAL Clamping Ring has three grooved channels which prevent water from accumulating on the cover.

Wagner Form W Transformers with the exclusive Wagner SHUR-SEAL Cover . . . *plus* Wagner Inhibited Transformer oil assure maximum protection against deterioration produced by "breathing" during the daily load cycle. Loss of oil during shipment or handling is also prevented. The SHUR-SEAL Clamping Ring maintains uniform pressure *around the entire periphery* of the cover—and yet permits easy removal of the cover by loosening a *single* stainless steel bolt. Wagner Form W Transformers offer sealed tank construction, air-tight as a welded tank, but with covers that can be removed if necessary.



Here's how the Wagner SHUR-SEAL Clamping Ring securely locks the cover to the tank. Corprene gasket is compressed to assure an air-tight seal.



The Wagner SHUR-SEAL Clamping Ring maintains *equal* pressure all around the cover.

Wagner Electric Corporation
EST. 1891

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AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

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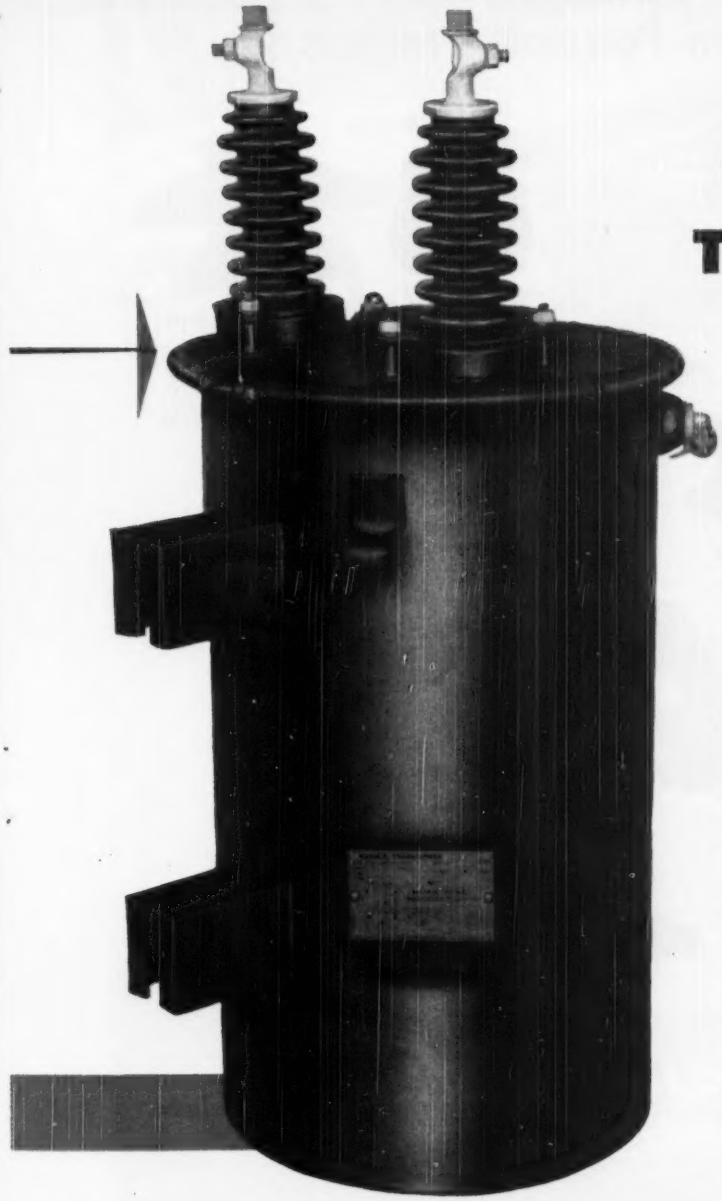
BRANCHES IN 31 PRINCIPAL CITIES

SHUR-SEAL Cover Inhibited Oil



Wagner

Form W

Transformers

Wagner Form W Transformers, with preformed cores of cold rolled oriented grain steel, are small in size, light in weight, yet are liberally designed. They are easy to handle, to store, and to mount on poles.

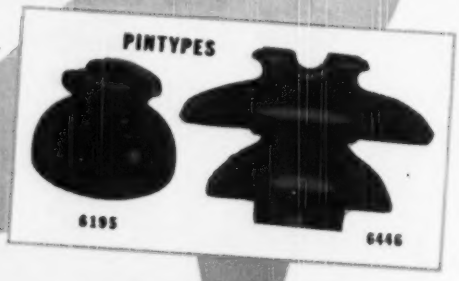
They give you excellent electrical performance . . . core and copper losses are low—regulation at both 100% and 80% PF is good—and exciting current is extremely low. High short time overload capacity provides good peak load performance. Form W Transformers are built to pay dividends in extra service—because they're built the Wagner way—with sixty years of transformer building experience behind them. Why not investigate them today?

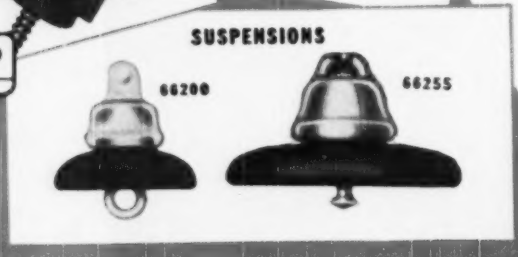
Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U. S. A.

Save Time on Every Job!

Order ALL Your Insulators and Accessories from Porcelain Products Inc.

Buy all your distribution and transmission insulators and accessories from one reliable source. Round out and complete your stocks with PORCELAIN PRODUCTS' complete line of performance-tested wet process porcelain insulators, and save time on both maintenance and new construction. Ask us to send a representative to discuss your needs. Catalog and price information sent on request.





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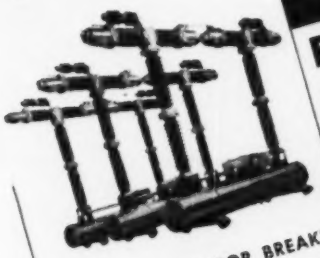
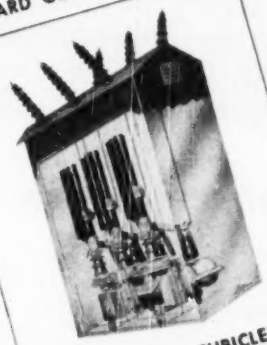
PROMPT DELIVERY!

Another Feature Of

BROWN BOVERI'S COMPLETE LINE OF OUTDOOR AIR BLAST BREAKERS



STANDARD OUTDOOR BREAKER



OUTDOOR CUBICLE

Of course, Brown Boveri air blast breakers have many *basic* advantages in addition to prompt delivery.

For one thing, you have a choice of either an outdoor breaker from 69 to 230 kV or an outdoor cubicle —from 14.4 to 46 kV.

What's more, you get a high speed breaker—3 cycles on any voltage available. You get positive interruption under all conditions including heavy capacity switching. You get a rapid reclosing breaker (3-phase all voltages, single-phase 69 kV up).

With its powerful air blast, Brown Boveri outdoor breakers eliminate all oil handling with a corresponding elimination of fire hazards. Inspection, too, is a simple, easy procedure. And maintenance is reduced to a minimum.

Naturally you'd expect that a Brown Boveri breaker was out-of-line in cost because of its world-famous quality and dependability. It will pay you to get the surprise of your life by securing a quotation on your outdoor breaker requirements. A list of standard outdoor types is shown below.

Standard Ratings	TYPE	kV CLASS	AMPS	INTERRUPTING CAPACITY*
OUTDOOR BREAKERS 69 TO 230 kV	69 k 1200	69	800 and 1200	1,200,000
	115 k 2000	115	800 and 1200	2,000,000
	115 m 3500	115	1200	3,000,000
	138 k 2500	138	800 and 1200	2,500,000
	138 m 3500	138	1200	3,500,000
	161 m 3500	161	1200	3,500,000
	161 m 5000	161	1200	5,000,000
	230 k 3500	230	800 and 1200	3,500,000
	230 m 6000	230	1200	5,000,000

All breakers for 3 CYCLES speed. All breakers suitable for *rapid reclosing*.

Standard Ratings	TYPE	kV CLASS	AMPS	INTERRUPTING CAPACITY*
OUTDOOR CUBICLES 14.4 TO 46 kV	14.4 n 500	14.4	1500	500,000
	14.4 n 1000	14.4	1500**	1,000,000
	23 m 500	23	1000	1,000,000
	23 n 1000	23	1500**	1,000,000
	34.5 m 500	34.5	1000	500,000
	46 m 1000	46	1000	1,000,000

All breakers with ASA standard speeds, also for 3 CYCLES speed if required.
All breakers suitable for *rapid reclosing, single-phase* and *three-phase*.

* Symmetrical or A.C. component. On fully asymmetric current, the breakers will safely handle 150% of these values.

** Higher current and interrupting ratings are available.

SPECIFICATIONS OF ALL BROWN BOVERI AIR BLAST BREAKERS *NOW AVAILABLE!*

Complete specifications in detail and dimensional diagrams can now be supplied for all types listed. Please indicate on the coupon at the right, type numbers in which you are interested.

WORLD ENGINEERING & MANUFACTURING LEADERSHIP IN MECHANICAL & ELECTRICAL POWER EQUIPMENT—FOR OVER 50 YEARS.

WRITE FOR SPECIFICATIONS AND DATA!

BROWN BOVERI CORP., 19 Rector St., New York 6, N. Y.

Please send me specifications on the following types: _____

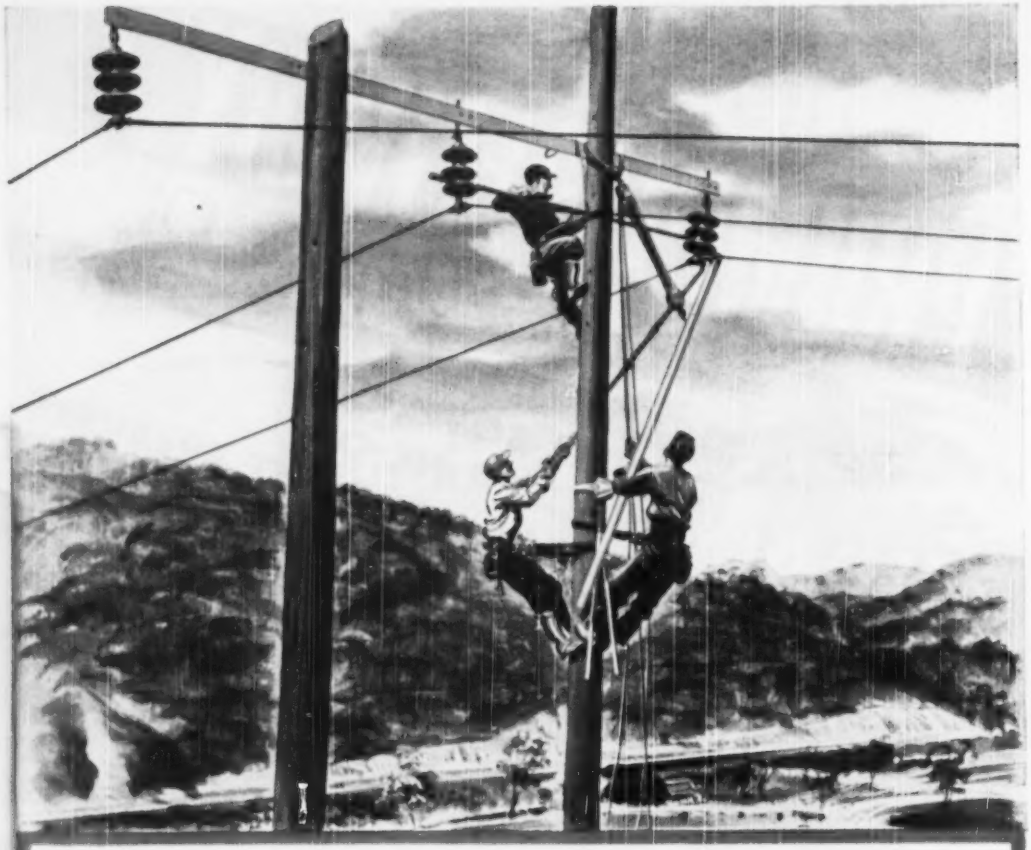
Name _____ Title _____

Company _____

Address _____

BROWN BOVERI

BROWN BOVERI CORP., 19 Rector St. • New York 6, N. Y.



Are You Interested in MAINTENANCE ECONOMY?

If yours is the problem of increasing service yet decreasing costs, now is the time to use Hoosier service. For 30 years, Hoosier engineers, trained men and special equipment have served utilities with every type of transmission line construction and maintenance. The efficiency of such an organization naturally results in operating economy. Whether Hoosier works alone or supplements your own organization, you can be assured of new-construction skill and efficiency on every maintenance job. Call Hoosier today.

From actual photograph of Hoosier crew at work in Kentucky.

HOOSIER ENGINEERING CO.

ERECTION AND MAINTENANCE OF TRANSMISSION LINES

NEW YORK • **1384 HOLLY AVE., COLUMBUS, OHIO** • CHICAGO

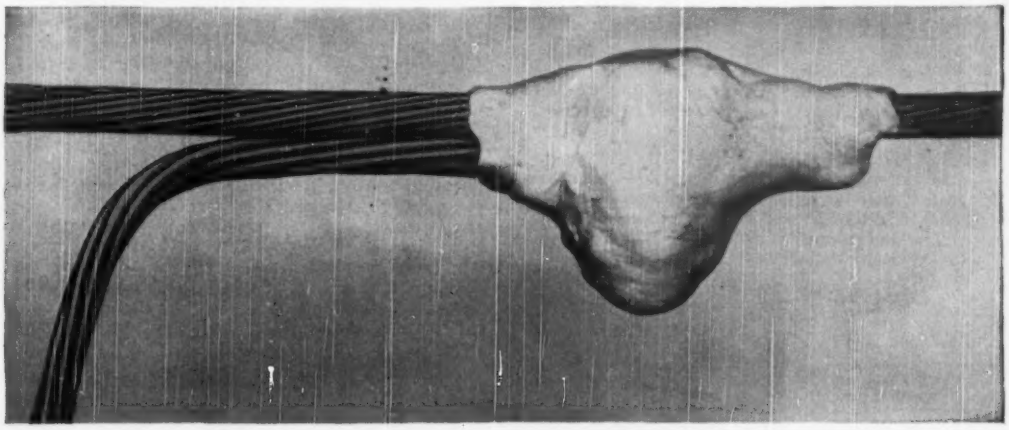
KEARNEY AIRSEAL

Kearney AIRSEAL is a pliable high-dielectric compound for use on all electrical connections, sealing out corrosion and oxidation in order to maintain electrical efficiency and eliminate overheating at joints. It is a chemically inert material which when applied to connections forms a permanent seal against the formation of high resistance contaminations. The second feature of AIRSEAL is its high dielectric strength (280 volts per mil, laboratory analysis) which makes it particularly valuable as both an anti-corrosion agent and as an insulator for connections where safety is an important factor.

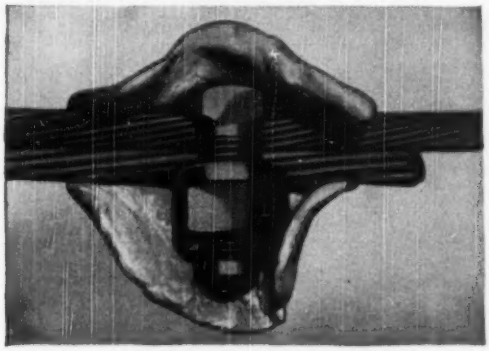
ELIMINATION OF CORROSION

Tests conducted by manufacturers, power companies and by the Copper Wire Engineering Association have shown that connector life can be extended indefinitely if corrosion and oxidation are eliminated in the connection. These tests indicate that trouble could be expected on any connector with a joint resistance exceeding 100 microhms, particularly in view of the high short circuit capacities of present-day circuits. Elimination of corrosion means the elimination of line burn-downs due to high resistance connections.

Kearney AIRSEAL prevents the encroachment between conductors of oxide and corrosion by forming an impervious seal over the connector and conductors at the joint. It does not deteriorate or harden with age and can be easily removed and replaced over and over with no decrease in its original sealing efficiency.



Kearney AIRSEAL applied over a connector maintains an efficient, high-conductivity connection by sealing out contaminating atmosphere, preventing the formation of high-resistance oxidation and corrosion.



Secure sealing of connectors is accomplished readily because of the pliability of AIRSEAL. Application is made by kneading the compound over the connector.

HIGH INSULATING QUALITY

Insulation of live parts for safety to the lineman and for the prevention of bird and animal trouble is readily accomplished with Kearney AIRSEAL. Its plasticity allows it to be shaped in any fashion to cover completely a terminal or connection. The advantage over a taped covering in this respect is augmented by the fact that AIRSEAL does not deteriorate, whereas tape hardens and has no ability to prevent corrosion formation.

Transformer terminals, oil circuit recloser terminals and the like are permanently protected against bird and animal trouble. Where safety to personnel must be provided, Kearney AIRSEAL provides an insulation strength of approximately 35,000 volts for an application 1/8th of an inch in thickness (based on the working factor of dielectric strength of 280 volts per mil, actual laboratory breakdown tests at 380 volts per mil). Transformer secondaries and all live parts, in substations or on the lines, are protected against danger to the workman through accidental contact.

continues on following page

The Mark of Quality Products
JAMES R. KEARNEY CORPORATION
4236 CLAYTON AVE., ST. LOUIS 10, MO.

GROUND CONNECTIONS

Ground rod connections are highly important, yet they are nearly always neglected. Many ground connections are inadequate to begin with, but even a firmly installed connection, when placed underground, is subject to extreme corrosive actions that may eventually cause a poor contact. Kearney AIRSEAL is unaffected by the corrosive agents in the earth and when used on ground connections provides a permanently clean connection.

Ground connections are kept corrosion-free by AIRSEAL.

Applying AIRSEAL to ground connections eliminates the danger of a high-resistance ground resulting from corrosion. AIRSEAL will not age or deteriorate, even when installed underground.

PHYSICAL PROPERTIES:

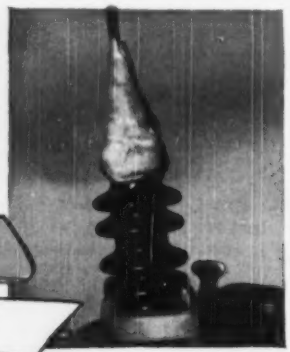
1. PLIABILITY: Kearney AIRSEAL is easily formed and readily salvaged for re-use. It will not stick to hands or gloves and can be applied in one-half the time necessary for taping. AIRSEAL will not harden at temperatures down to minus 50°F., nor will it flow at temperatures up to 250°F.
2. DIELECTRIC STRENGTH: 280 volts per mil (working strength.)
3. INFLAMMABILITY: AIRSEAL will burn; however, it is not to be classified as an "inflammable material," since a direct flame must be applied to it to cause combustion. It burns with a slow flame similar to that of electrical tape.
4. CHEMICAL ACTIVITY: AIRSEAL is chemically inert, unaffected by either contaminated atmosphere or by ground agents. It does not permit penetration of these agents, sealing out oxide and corrosion from metallic parts encased in the sealant.

APPLICATION

To derive the maximum benefit from the corrosion-preventive property of Kearney AIRSEAL, conductors should be initially free from contaminations. In this respect the same precautions taken to insure a proper contact in any connection should be observed. The normal copper oxide film present on new conductors has been found to have little or no effect on joint resistance if the connector is properly tightened. However, where conductors have been in service and exposure has resulted in encrustations of dirt and oxidation compounds, a wire brush should be used to remove these insulating contaminations.

The AIRSEAL is applied by kneading it over the terminal or connector, maintaining a minimum thickness of 1/8th of an inch.

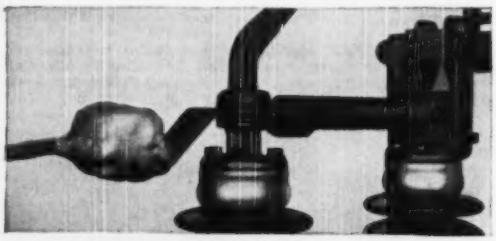
Write for Free Sample and Prices



Bird and animal trouble on primary terminals of transformers and oil circuit reclosers is eliminated by sealing terminals with AIRSEAL.

Injuries due to accidental contact with transformer secondary terminals and other exposed terminals can be prevented by an application of AIRSEAL.

AIRSEAL is packed in boxes of 20 handy-size (4" x 2½") pads, ⅛-inch thick. One pad will completely cover and seal a No. 4 copper connector.



Bulky terminal adapters and other irregular contours are easily covered with AIRSEAL. To remove, it is necessary only to peel off the protective seal.

The Mark of Quality Products
JAMES R. KEARNEY CORPORATION KEARNEY 4236 CLAYTON AVE., ST. LOUIS 10, MO.

"KEARNEYS" "CONNECTORS" "CON-NEC-TITES"

Call them CONNECTORS or Call them KEARNEYS...

to the men who use them, the names mean the same.

In 1926, the James R. Kearney Corporation introduced solderless connectors and called them CON-NEC-TITES. Since that time, because Kearney has consistently been the leader in the Connector field, the names Kearney and Connector have become synonymous.

Mindful of the fact that leadership in an industry requires constant improvement in the product, Kearney engineers are always searching for better material and design. That's why Con-nec-tites can now resist 330 inch pounds of torque and provide 80% conductivity. There are 75 Standard Kearney Con-nec-tites in sizes from 1,000,000 CM to the small No. 10. Prices and quantity discounts sent on request.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

Better Construction • SAFER Maintenance

No weather's too tough for DURALINE

Exposed to cold, snow, sleet . . . rain, fungi, heat . . . the wonder is that even the best "weatherproof" wire lasts as long as it does.

DURALINE* URC Weatherproof, especially, has an amazing record of endurance—and it won't festoon.

We'll be glad to furnish complete information on Duraline with either copper or aluminum conductor. Just ask your nearby Anaconda Sales Office or Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

The right cable for the job **ANACONDA®**

WIRE AND CABLE

RCA SUPER Carfone 2-way radio system

—for areas where the going is TOUGH!

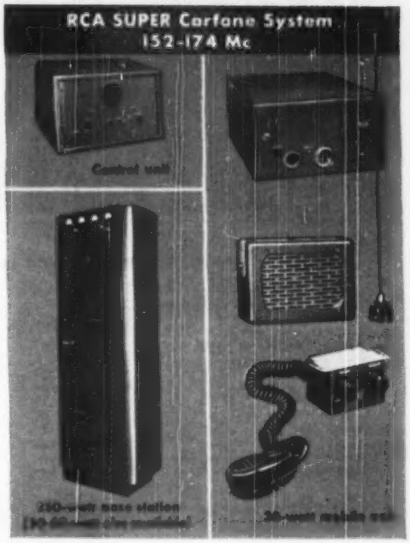
- **Gets through in all kinds of terrain**
- **Causes no interference to neighboring systems**
- **Pierces poor radio locations**
- **Clear reception through interference**
- **Improved message intelligibility**

Now reliable communication in congested metropolitan areas is *a practical reality*—with the RCA SUPER Carfone System.

For example, radio vehicles can operate to within a few feet of adjacent-channel stations without receiving interference. Mobile units have the power to "override" the dead spots—communicate from inside the radio shadows of tall buildings and high hills. In the open country, a SUPER Carfone can increase your coverage *as much as 20%*. And that's not all!

SUPER Carfone Systems are engineered to do away with interference to other services, such as television, air navigation, and neighboring communication systems. Mobile units save substantially on tubes and battery...because they operate at low current on standby. Dynamic balancing reduces mechanical vibration—adds materially to equipment endurance.

Let us put complete information in your hands at once. Write Dept. 51L, RCA Engineering Products, Camden, N. J.—*today!*



MOBILE COMMUNICATIONS SECTION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Cables run COOLER...
in TRANSITE DUCTS

... reducing copper losses
... increasing current capacity
... prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV
(6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C.

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	100.

Johns-Manville *Transite Ducts*

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

BLACKBURN
Hi-Strength
TWO-BOLT CLAMP

ECONOMICAL!
EFFICIENT!
COMPACT!

A BETTER CABLE CONNECTOR AT LESS COST!

- Especially designed for medium and large stranded wire and cable.
- Produces very high clamping pressure resulting in low resistance joints on stranded wire.
- It costs much less than other types of connectors commonly used.
- It is excellent for dead ends, taps, and service entrance connections and will accommodate a range of wire sizes.
- Exclusive helical serrations in both body and cap, conforming to the lay of stranded wire, together with the high clamping pressure produce a joint which will not pull apart. Thus the Blackburn Two-Bolt CLAMP is excellent for dead ending.
- It's made of high strength alloys throughout. Its extra strength maintains the high "pressure between wires" indefinitely. Thus it makes a lasting, trouble-free connection.
- It's compact and easy to tape — makes a neat joint.
- It's simple and easy to install.
- Made in sizes 1/0 to 1000 MCM.

Jasper Blackburn Corporation

35 MADISON ST. • ST. LOUIS 6, MO.

Phone CEntral 3007

Mail Coupon for Sample and Full Details

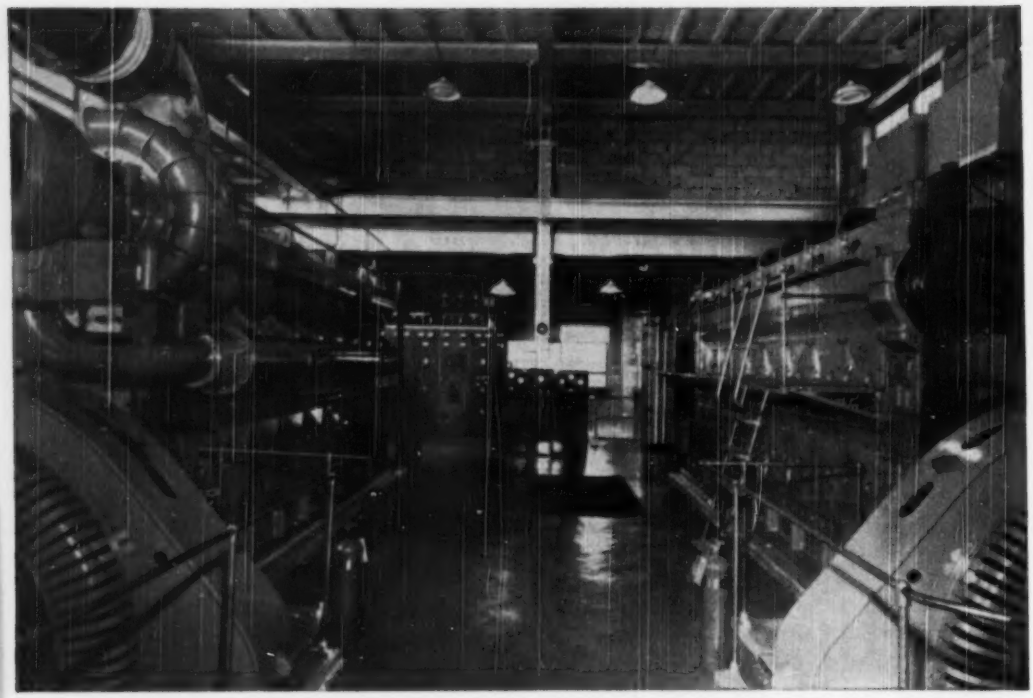
Send me sample and further information on the BLACKBURN TWO-BOLT CLAMP.

Wire Size Used _____

Your Name _____

Company _____

City & State _____ EW



Superior Diesels Put Costs on the Skids

A private power company in Wisconsin needed additional generating capacity. And they got it from two supercharged Superior Diesels. Each of these engines develop 1440 hp. at 360 rpm. And each one has a bore and stroke of 14½" x 20" and 1000 KW capacity.

The plant engineers report that both engines have met ever-increasing loads with a very high degree of efficiency. And they are enthusiastic about low fuel and lube oil consumption.

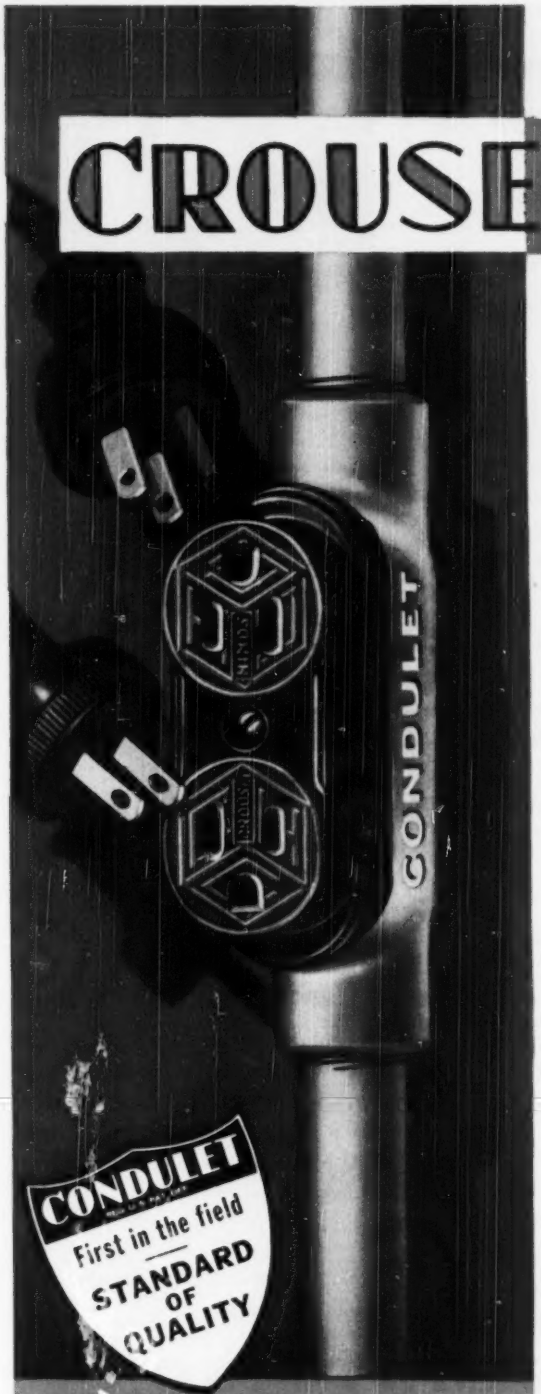
For example, one unit delivered power loads from 500 to 800 KW. During this period the engine averaged 14.55 KWH per gallon of fuel. Today, even though they are not yet operating at their best capacity rating, both engines are generating over 14 KWH per gallon of fuel.

Superior representatives welcome the opportunity of showing how Superior Diesels put power costs on the skids. Why don't you have one of them call at your convenience? There's no obligation, of course. And when you contact us, ask for a copy of *Superior Diesel For Stationary Application.*

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

Superior ENGINES
ATLAS Imperial DIESEL ENGINES

Locomotive · Marine · Oil Field · Stationary



Coming soon!

CROUSE-HINDS

SAFETY

2-Wire, 3-Pole

Grounding Plug Receptacle

for

OBROUND CONDULETS

It gives you a positive ground circuit and will not accept ungrounded 3-pole attachment plugs

1. A duplex receptacle designed in accordance with the new standards established by NEMA and approved by ASA.
2. Has two parallel blade current carrying contacts and one "U" – shaped grounding contact.
3. The receptacle takes the new plug caps with two parallel blades and one "U" – shaped contact. It also takes the standard two blade parallel non-polarized and two blade parallel polarized plug caps.

This safety grounding plug receptacle for Obround CONDULETS is one of the thousands of items in the complete CONDULET line. Use sturdy cast Feraloy CONDULETS and rigid conduit on every installation.

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

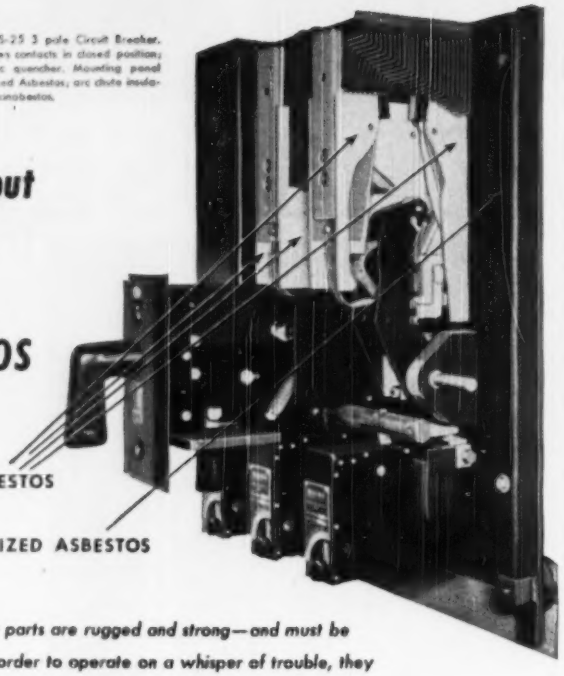
Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. Resident Representatives: Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va.
CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

(CONDULETS are made only by CROUSE-HINDS)

CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS

Roller-Smith RS-25 3 pole Circuit Breaker. Cut-away shows contacts in closed position; interior of arc quencher. Mounting panel is K&M Ebonized Asbestos; arc chute insulation is K&M Monobestos.

Breaker components stay put when mounted on K&M EBONIZED ASBESTOS



For positive action, circuit breaker parts are rugged and strong—and must be mounted the same way. Yet, in order to operate on a whisper of trouble, they must be assembled with precision. ROLLER-SMITH meets both these requirements by mounting RS-15 and RS-25 Breakers on panels of K&M Ebonized Asbestos.

K&M Ebonized Asbestos has high mechanical strength—resists shock and vibration. It's strong dielectrically, also, and is highly resistant to the effects of temperature changes. Yet, for all its strength, K&M Ebonized Asbestos is easy to handle and cut, machines neatly, drills quickly—saves time and trouble in production and assembly.

This unusual K&M mounting material is made of asbestos fiber and portland cement, pressure-molded to high density, and impregnated with special insulating compound. Standard sheet thicknesses are from $\frac{1}{8}$" to 4".

If you manufacture or use switchboard mountings, bus bar runs, switchgear compartment linings, test tables, bench boards, or any panel-mounted electrical equipment, it will pay you to investigate K&M Ebonized Asbestos. We'll be glad to send complete information upon request.

Where high heat-resistance is needed — K&M MONOBESTOS

In the breaker photo above, you see K&M Monobestos used as insulating material in the arc quencher unit. Monobestos was selected for this important service because it has both heat resistance and durability. K&M Monobestos is easy to cut and to drill. Complete information on request.

Nature made Asbestos . . . *Keasbey & Mattison has made it serve mankind since 1873*

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

BARS - PLATES - STRUCTURALS - SHEETS - TUBING - REINFORCING BARS - STAINLESS - ALLOY & HI-STRENGTH STEELS - ALUMINUM - TOOLS - SUPPLIES - MACHINERY
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"Diversified stocks"... that's only one of the things we mean by Service Plus!

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ALLOY STEELS
ALUMINUM
▲
TOOLS · EQUIPMENT
MACHINERY

● Many of our customers think of United States Steel Supply as the "department store" of the steel industry. That's exactly what we aim to be . . . a source of supply that carries a diversified stock of steel, aluminum, tools, equipment and machinery so that customers' requirements can be met. Customers who have shopped around come back to us with comments like these: "Only place we could find what we wanted." "We were hunting an odd size . . . *you had it!*"

You can depend on us for more than diversified stocks, however. *Service Plus* means prompt delivery, and instant, courteous attention to any problems you have involving material selection. It means *You're the Boss* and we're going to do our best to keep you satisfied.

WHEN YOU DEAL WITH US, YOU GET Service Plus!

UNITED STATES STEEL SUPPLY COMPANY

USS

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UNITED STATES STEEL

When a project has been "engineered and constructed by EBASCO" you can be certain that the most modern, scientific engineering methods have been employed.

"engineered and constructed by EBASCO"

Whenever you see the EBASCO SERVICES sign on a construction project, a team of specialists is at work, helping management get the job done *quickly* and *efficiently* and in a manner that will assure the finest and most modern plant possible.

Today, EBASCO is handling projects for business organizations, industrial companies and public utilities throughout the world. But EBASCO provides other services besides design and construction. It helps business with problems of financing, production, industrial relations, purchasing, systems and methods—in fact, with any problem whose solution will contribute to greater plant efficiency.

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a. Outdoor and semi-outdoor steam and hydroelectric plants.
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We will be glad to send you the booklet *"The Inside Story of Outside Help"* describing the many EBASCO services available to you. Address Ebasco Services Inc., Dept. M., Two Rector Street, New York 6, N. Y.

EBASCO SERVICES

INCORPORATED

NEW YORK · CHICAGO · WASHINGTON, D. C.

Ebasco Teamwork gets things done anywhere in the world

ENGINEERS · CONSTRUCTORS · EBASCO · BUSINESS CONSULTANTS

Appraisal
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Rates & Pricing
Research
Sales & Marketing
Systems & Methods
Taxes
Traffic

CORNELL-DUBILIER CAPACITORS
FOR POWER-FACTOR IMPROVEMENT

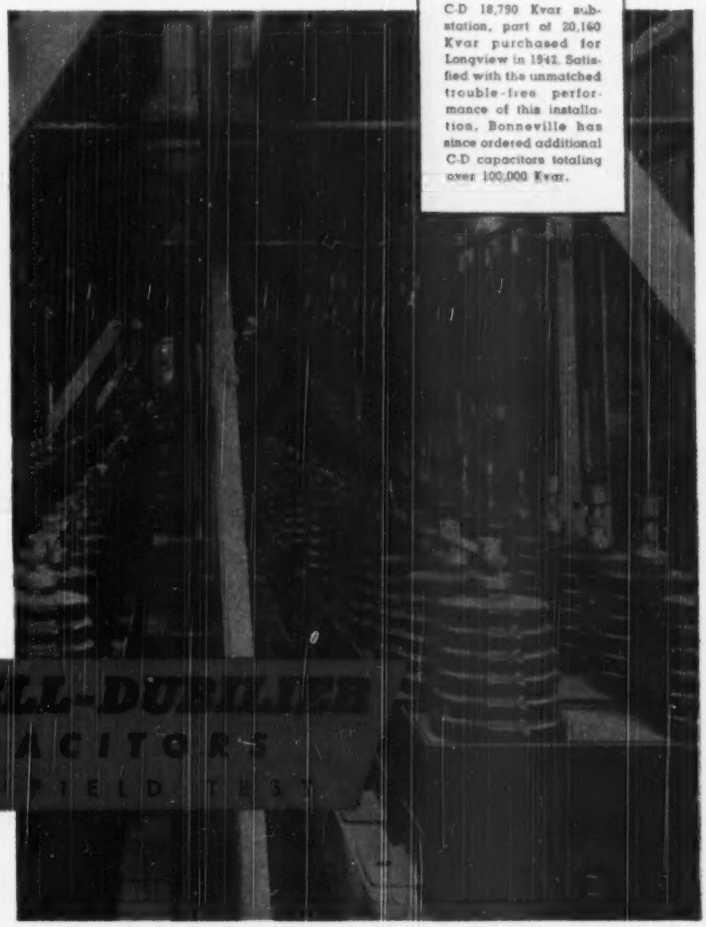
these C-D capacitors have given over

1⅓ BILLION KVAR HRS.
OF 99.5% TROUBLE-FREE SERVICE
on the Bonneville Power Administration System

Here's why:

- **Lowest dielectric unit stress and highest major insulation level.**
- **Bushing cavity Dykanol filled and completely insulated from capacitor cavity. Increases the accepted flash-over safety factor.**
- **Wide margin maintained between paper and foil coordinated with major insulation to provide highest impulse level.**
- **Submersion in special non-inflammable and non-explosive Dykanol impregnant, results in high stability and long life.**
- **C-D design results in the lowest volt-amperes per square inch of radiating surface.**

To supply the vast amount of power required by the growing aluminum industry in the Northwest, Bonneville Power Administration has made increasing use of power-factor capacitors. Bonneville reports that its C-D capacitors have so far delivered 1,316,803,200 Kvar/hrs. of 99.5% trouble-free service — an unmatched field performance record!



C-D 18,790 Kvar substation, part of 20,160 Kvar purchased for Longview in 1942. Satisfied with the unmatched trouble-free performance of this installation, Bonneville has since ordered additional C-D capacitors totaling over 100,000 Kvar.

Write for catalog. ***Cornell-Dubilier Electric Corp.,*** *South Plainfield, N. J.*

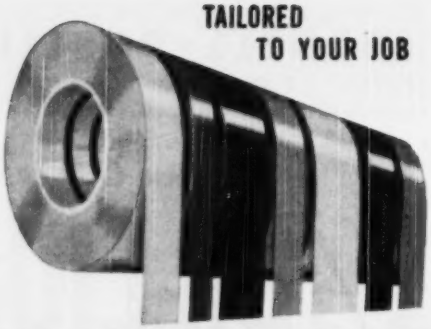
Other Plants: *New Bedford, Worcester, Brookline, Mass.; Providence, R. I.; Indianapolis, Ind.; Cleveland, O.*

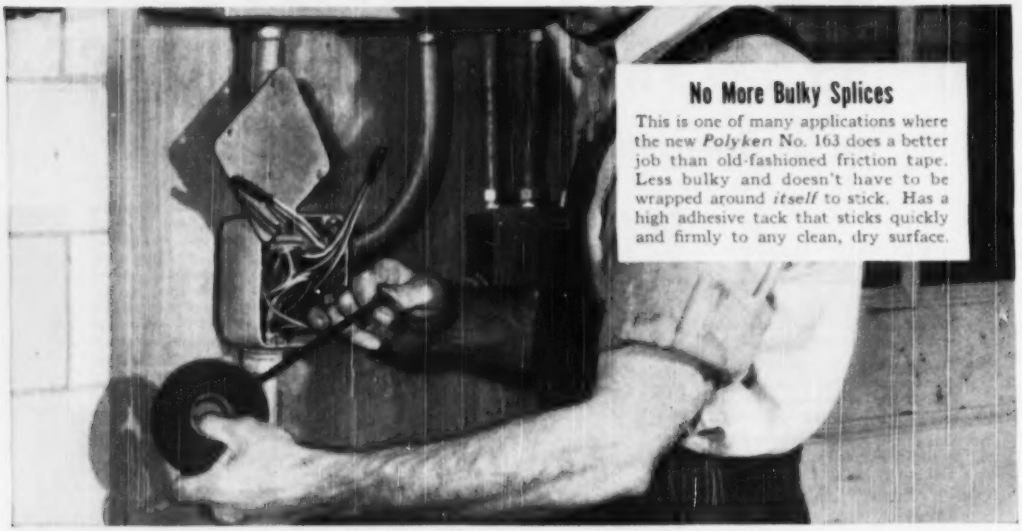
THE NEW

Polyken®

INDUSTRIAL TAPES

TAILORED TO YOUR JOB





No More Bulky Splices

This is one of many applications where the new *Polyken* No. 163 does a better job than old-fashioned friction tape. Less bulky and doesn't have to be wrapped around *itself* to stick. Has a high adhesive tack that sticks quickly and firmly to any clean, dry surface.

After 70 years—an electrical tape that costs less than friction tape

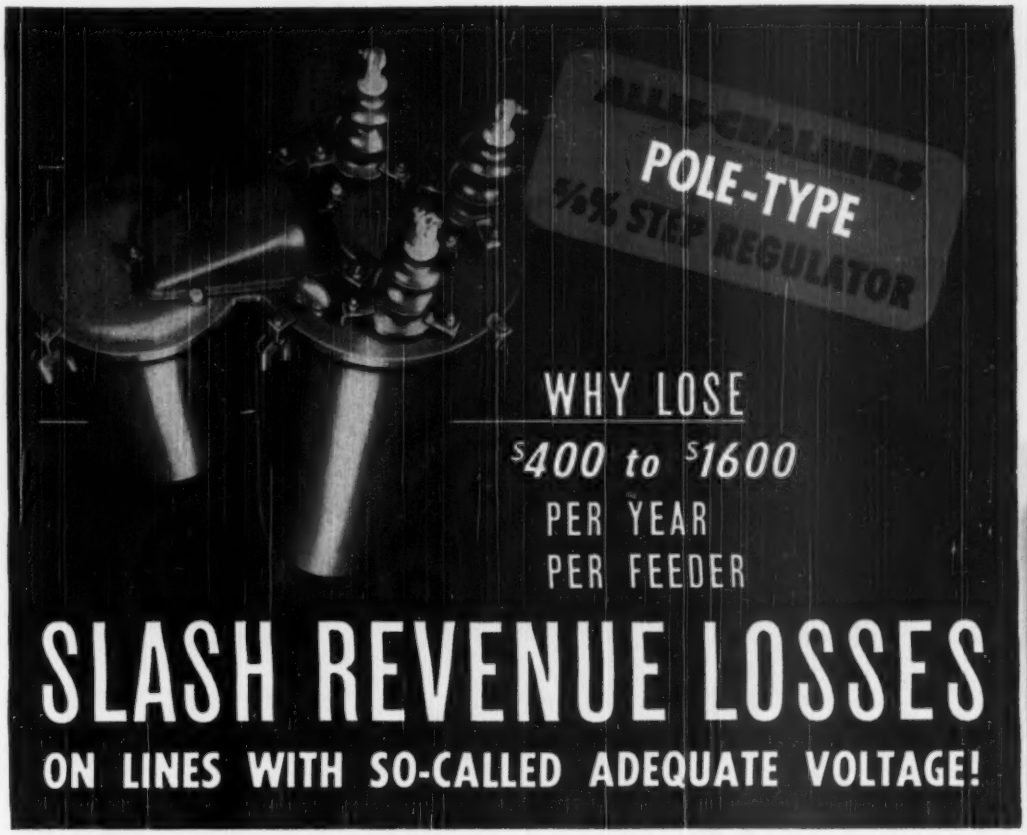
This is the first new thing that's happened in the friction tape field in nearly a century—*Polyken* No. 163. An electrical tape that sticks to any surface as well as to itself. It has higher dielectric strength with less bulk. Forms a better moisture barrier. Doesn't fray. Sticks better and is easier and cleaner to handle.

All this, new *Polyken* No. 163 brings you . . . yet costs less than old-fashioned friction tape! See your Polyken distributor today.

FREE BOOKLET

To learn more about revolutionary new tape, *Polyken* No. 163, write for free folder, "Test It Yourself!" Address *Polyken*, Dept. EW-5, 222 W. Adams St., Chicago 6, Ill. Or call your distributor.

Polyken Industrial Tape, Department of Bauer & Black, Division of The Kendall Company



SLASH REVENUE LOSSES

ON LINES WITH SO-CALLED ADEQUATE VOLTAGE!

OPERATORS ARE LOSING $4 to $8 per customer each year on lines with so called "adequate" voltages of 105 to 110 V. And your customer is losing too! Motor life is shortened . . . light bulb efficiency is low . . . heating is slow. Users are losing money whether they know it or not.

And operators are losing money too! Low voltage means consumption is lower than it should be . . . hence revenue is lower than it need be. It costs money not to regulate voltage.

Regulators are a common method of raising voltage and cutting revenue losses. But there's a big difference in regulators. Judge a regulator by the band width it holds.

A regulator that holds a narrow 2-volt band can maintain average voltage 1 volt higher than a regulator holding a 4-volt band. That's the band width advantage! Only Allis-Chalmers builds a pole-type step regulator that can hold a 2-volt band.

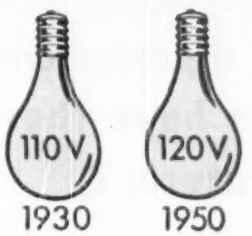
You can use the band width advantage in any of three ways:

1. You can increase revenue.
2. You can increase load carrying capacity.
3. You can extend feeder length.

Low voltage is practically a universal problem. Every day you wait to correct it you are losing money that can never be reclaimed. Call your nearby Allis-Chalmers Sales Office now for the complete story on what regulators can do for you.

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

"Adequate" Voltage Isn't What It Was!



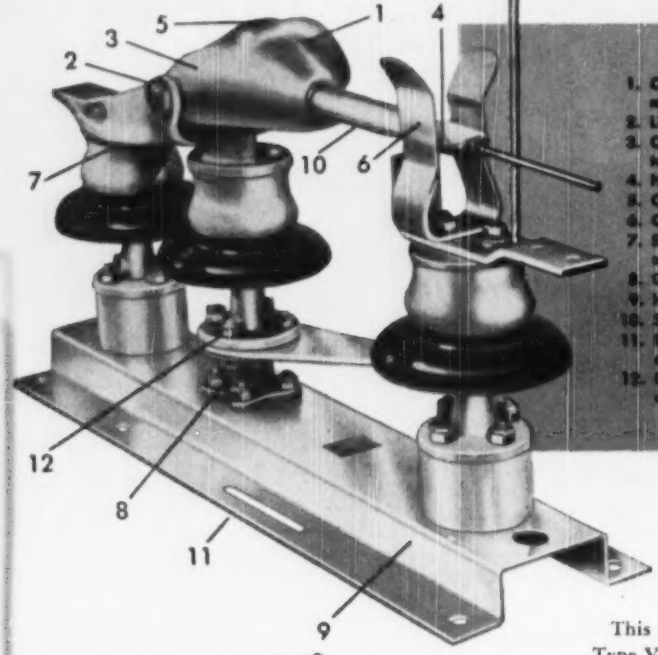
Today light bulbs and most appliances are rated 115 or 120V. Users and operators both suffer when voltage is lower than this. Good voltage is good for everyone.

-3180

ALLIS-CHALMERS

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



1. Completely-enclosed hinge-end mechanism.
2. Live-side bearings, lubricated for life.
3. Completely-enclosed solid bridging contact at hinge end.
4. High-pressure line contacts.
5. Only three moving parts.
6. One-piece break jaw.
7. Simplified end enclosed counterbalancing spring.
8. Greaseless, rotating insulator bearing.
9. High-strength, heat-plate steel base.
10. Single tube blade.
11. Flat mounting surface with no downward extensions.
12. Universal operating mechanism for group operation.

LOOK CLOSELY!

Do your disconnecting switches have these features?

Check the above features closely. Each one *alone* means a better switch for your money. Install the Westinghouse Type V and you get them *all*.

This combination of vital features makes the Type V the leader of the switch field in dependability, economy and low maintenance. Get the benefits of experience and top-grade switch design in *your* system. Install the Westinghouse Type V.

For complete information on the Type V, or on the entire Westinghouse switch family, get in touch with your nearby Westinghouse office or distributor. Ask for B-4241 and B-4726. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60699

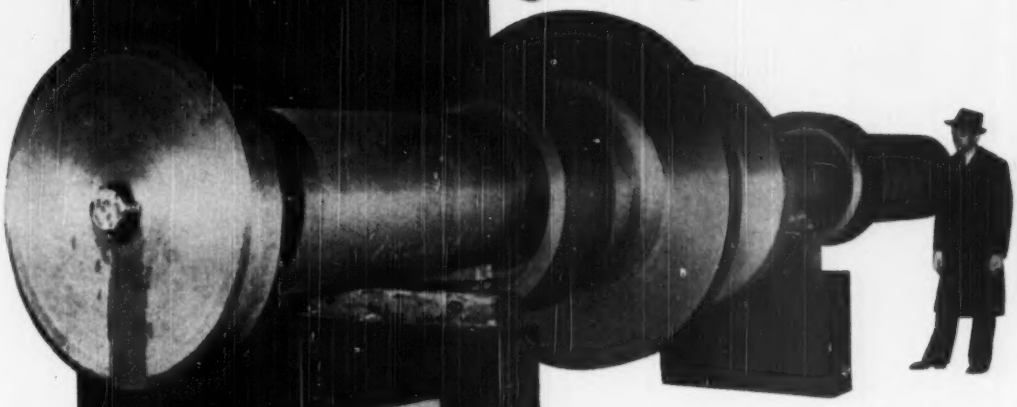
Westinghouse

TYPE V

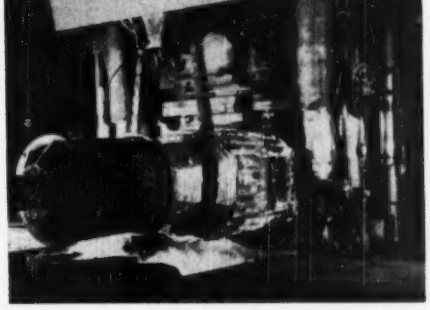
DISCONNECTING SWITCHES

COME TO US FOR

heavy forgings



☆ THE FINEST STEEL
☆ FORGED WITH SKILL
☆ FINISHED BY EXPERTS



The picture shows a typical heavy forging on the last leg of its journey through the Homestead District Works of Carnegie-Illinois Steel Corporation.

From ore to ingot, from forging to finished machining, it was produced by Carnegie-Illinois men with many years of solid experience. In the long run, it's these men that assure your satisfaction with the finished product.

But they also have the *equipment* to back them up. Our ingots are handled in precision heat-treating furnaces and forged in our modern hydraulic presses. Forgings are rough or finish machined in a shop that contains all necessary turning, boring and planing equipment.

No matter what kind of heavy forgings you need—generator shafts . . . water wheels . . . rotors . . . reduction gears . . . or special forgings of any type—see us first. Let us quote on your requirements. You're not obligated in any way.

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S HEAVY FORGINGS

D-1067

UNITED STATES STEEL

Testing for sound lost between telephone receiver and ear. Many subjects were used in these tests.

How to compensate for a curl . . . and add to your telephone value

Bell scientists know that the telephone is not used under ideal laboratory conditions. There is never a perfect seal between receiver and user's ear. A curl may get in the way, or the hand relax a trifle. And ears come in many shapes and sizes. So some sound escapes.

Now, sound costs money. To deliver more of it to your ear means bigger wires, more amplifiers. So Bell Laboratories engineers, intent on a thrifty telephone plant, must know how much sound reaches the ear, how much leaks away. They mounted a narrow "sampling tube" on an ordinary handset. The tube extended through the receiver cap into the ear canal. As sounds of many frequencies were sent through the receiver, the tube picked up a portion, and sent it through a condenser microphone to an amplifier. That sampling showed what the ear received.

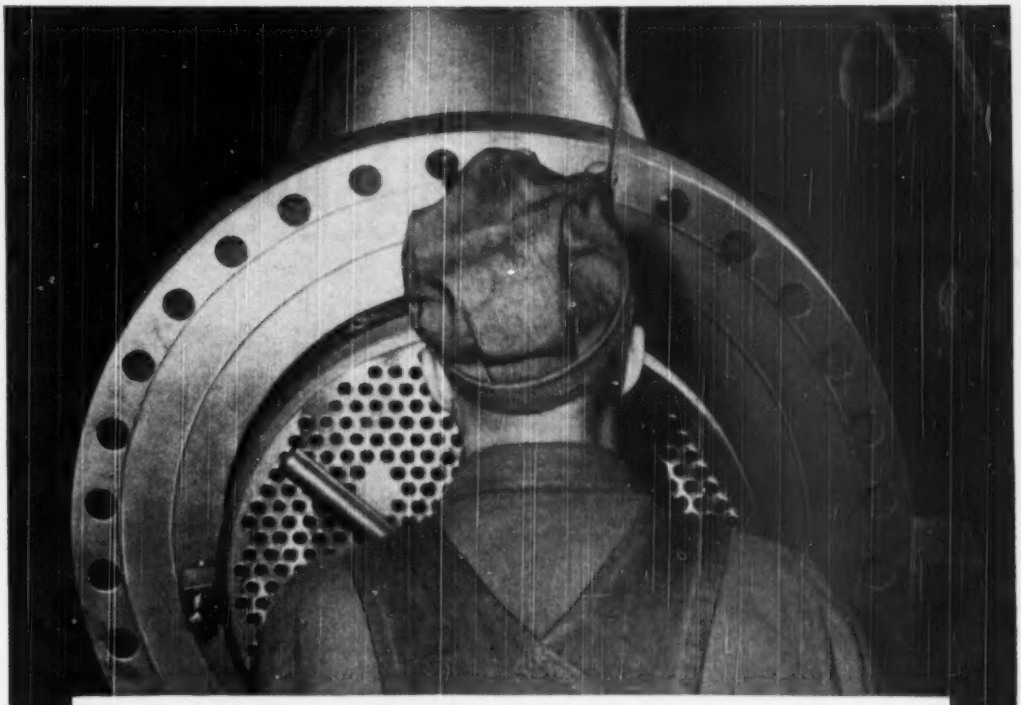
As a result, Bell scientists can compensate in advance for sound losses—build receivers that give *enough* sound, yet with no waste. That makes telephone listening always easy and pleasant.

It's another example of the way Bell Telephone Laboratories work to keep your telephone service one of today's biggest bargains.

Automatic recorder plots sound pressures developed in the ear canal at different frequencies.

BELL
TELEPHONE
LABORATORIES

Working continually to keep your telephone service big in value and low in cost.



Looking ahead to years of service?

CHASE ANTIMONIAL ADMIRALTY (a patented alloy)

If you want condenser tubes that will stand up for years under tough field conditions, remember...Chase Antimonial Admiralty* Condenser Tubes last longer! It's the antimony that does it!

These great condenser tubes have *enough* antimony to resist dezincification. And, in addition, antimony is one inhibitor that will not weaken the tube. A metallurgist would say, "Antimony, as an inhibitor, does not increase susceptibility to intergranular corrosion or nonhomogenous grain structures." In plain words this simply means that the metal starts with the right grain structure and retains it . . . it stays tough and ruggedly withstands the stresses of heavy duty assignments.

That's why you'll do better with Chase Antimonial Admiralty Condenser Tubes! Cost? No greater than plain Admiralty.

*U. S. Pat. No. 2,061,921

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses: NEW YORK, BALTIMORE, NEW ORLEANS LOS ANGELES, SAN FRANCISCO

also carried by— Vinson Supply Co., Tulsa; Standard Brass & Mfg. Co., Houston

Chase

the Nation's Headquarters for BRASS & COPPER

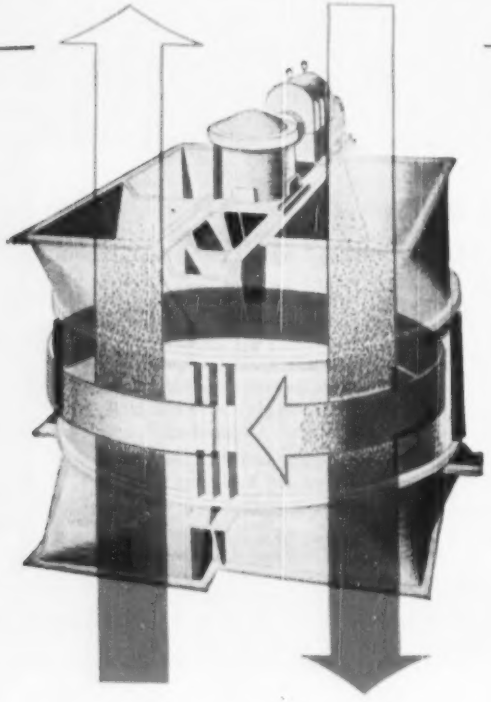
WATERBURY 20 CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY · ATLANTA · BALTIMORE · BOSTON · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · HOUSTON · INDIANAPOLIS · KANSAS CITY, MO. · LOS ANGELES · MILWAUKEE · MINNEAPOLIS · NEWARK · NEW ORLEANS · NEW YORK · PHILADELPHIA · PITTSBURGH · PROVIDENCE · ROCHESTER · ST. LOUIS · SAN FRANCISCO · SEATTLE · WATERBURY · Sales Office Only

Increase the efficiency of your present boiler

with the *Ljungstrom* AIR PREHEATER



The installation of a Ljungstrom air preheater on your present boiler offers the opportunity for considerable fuel savings that will more than offset the initial cost of the preheater in a matter of a few years.

The regenerative counterflow principle of the Ljungstrom permits operation at lower exit gas temperatures . . . assuring increased heat recovery and reducing the amount of fuel required. Moreover, the compactness and lightness of the preheater makes it possible to install it on your present boiler with minimum change in the existing structure.

For more information as to how you can approach modern performance standards with a boiler that is operating without an air preheater, or with out-of-date air preheater, write to the Air Preheater Corporation. Our engineers will welcome the opportunity to show you how the Ljungstrom can raise the over-all efficiency of your plant.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 EAST 42nd ST. · NEW YORK 17, NEW YORK

Save (6) ways with G.E.'s new

All-purpose Insulating Varnish

Now you can really cut motor repair costs to the bone by using General Electric's new all-purpose insulating varnish. Here's why:

1. Costs less than previous G-E all-purpose varnishes.
2. Simplifies inventories: This all-purpose varnish combines the electrical, chemical and mechanical properties needed for full insulation protection.
3. Has long tank life—prevents gelling and skinning waste.
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5. Requires no special thinners—just petroleum spirits.
6. Needs fewer cover coats.

For more information on how this new all-purpose insulating varnish can help you cut electrical repair costs, get in touch with your local G-E Distributor, or mail the coupon below.

G. E.'s new all-purpose varnish is one of G. E.'s line of electrical insulating materials, including insulating varnishes, sealing and filling compounds, varnished cloth and tapes, silicone insulation, and mica insulation.

You can put your confidence in

GENERAL ELECTRIC

Section K4, Chemical Department
General Electric Company
Pittsfield, Massachusetts

Please send me more details about G. E.'s new all-purpose insulating varnish.

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Business _____

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You're entitled to the EXTRA COVERAGE

—of a Kidde Dry Chemical Fire Extinguisher

Pound for pound, *Kidde* Dry Chemical Fire Extinguishers give you more *protection* for fires in flammable liquids, live electrical equipment and for textiles.

Proof? Factory Mutual Laboratories requires a 20 lb. dry chemical fire extinguisher, in the hands of an experienced operator, to effectively cover 25 square feet of burning area. *The Kidde 20 pounder covered 36 square feet . . . a 44% margin of safety!* And—the tests require a 30 pounder to cover 35 square feet . . . *but Kidde's Dry Chemical extinguisher reached out 48 square feet!*

Why is Kidde better? A special Diffuser Horn applies heat-absorbing, fire-smothering dry chemical in an effective cloudlike pattern that blankets the danger area, helps eliminate splashing of burning liquids, and protects the operator from heat.

Ruggedly built, simply constructed, quick to recharge and equipped with easy-to-operate Trigger Finger Control, *Kidde* Dry Chemical Extinguishers mean sure death to fire—and extra safety for you.

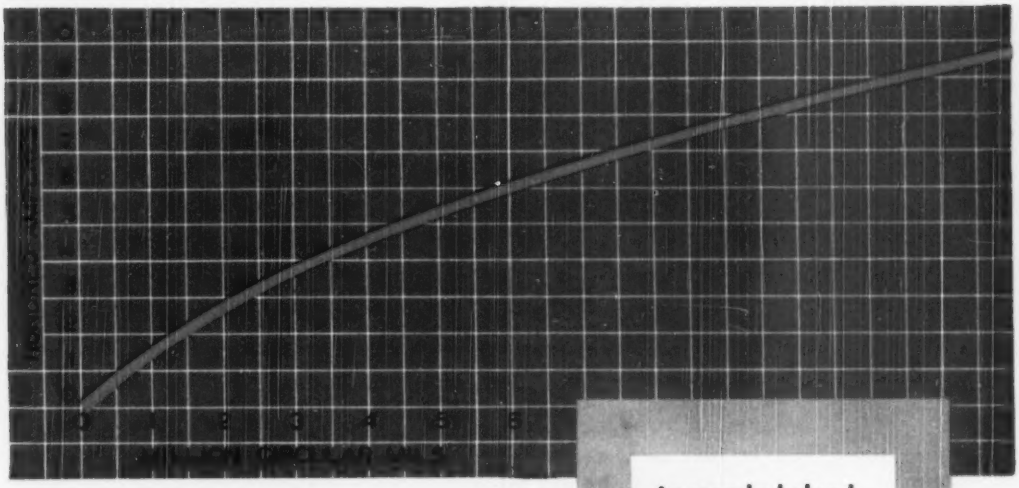
Kidde Dry Chemical Extinguishers can be used in normal standing position, just pick unit up, point the horn, pull the trigger.

Streamlined diffuser horn gives better discharge pattern, means greater coverage, insulating blanket for the operator.

Kidde

Walter Kidde & Company, Inc., 1230 Main Street, Belleville 9, N. J.
In Canada: Walter Kidde & Company, Ltd., Montreal, P. Q.

BUS CONDUCTOR DESIGN FACTORS and PROBLEMS



No. 6. Bus Conductor Design and Material

Fundamentally, the best bus conductor is one that will carry maximum load adequately at lowest final cost. Operating temperature is generally regarded as the principal load-limiting factor. In a well-designed bus conductor the low electrical resistance of copper (and of copper oxide when or if formed) assures highest load capacity with least joint troubles.

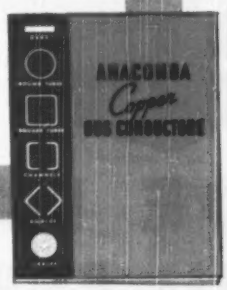
Proper design of bus conductor section is often essential to full utilization of copper's uniquely favorable electrical, thermal and mechanical properties.

Our Technical Department will help you plan for and select efficient and economical bus equipment for any requirement. Ask for the booklet, "ANACONDA Copper Bus Conductors." The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

80140

Anaconda helped develop modern bus bar design

Anaconda has long been a leader in bus conductor engineering. Today ANACONDA *products and technicians are cooperating effectively throughout the entire field of power generation, distribution and application to provide bus conductors that will afford maximum capacity, security and economy for any specified job.*



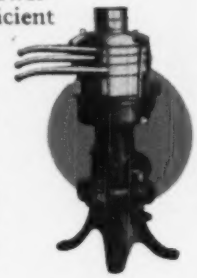
Carry the load with ANACONDA® Bus Conductors

WHIRLING MILESTONES

De Laval today offers a centrifuge for every purification need in the power field. Back of every recommendation stands nearly three-quarters of a century of being ***first*** in major centrifugal developments.

1878 Carl Gustav De Laval invented the first continuous Cream Separator. He tried tubular bowl design.

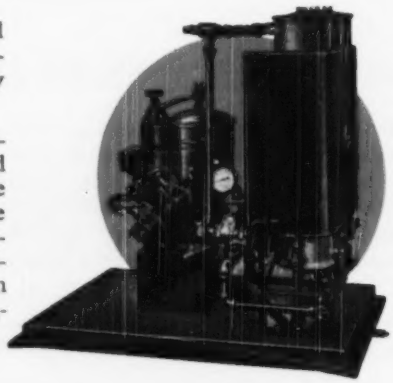
1890 Dr. De Laval abandoned tubular bowl, invented slower-speed disc bowl to stratify liquid for more efficient purification.



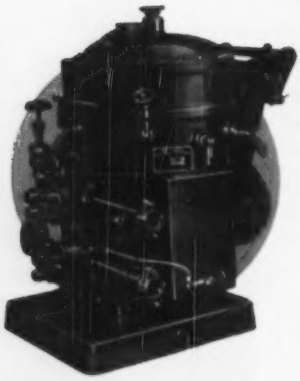
1918 First centrifugal Oil Purifier introduced by De Laval. This continuous Oil Purifier was driven by a small steam turbine.

1922 First De Laval centrifugal Insulating Oil Purifier installed. In 1950, the centrifuge is still the safest way to maintain insulating oil because water, once discharged, cannot recontaminate the dry oil.

1950 Full range of "Uni-Matic" Oil Purifiers now available, including No. 67 with a capacity of approximately 450 gph.



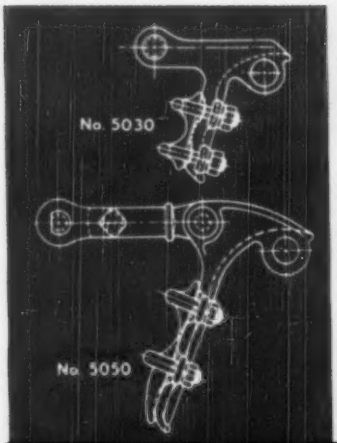
De Laval "Puri-Filter," combining centrifugal force and filtration, makes possible the removal of fly ash or moisture haze as well as more dangerous impurities. The "Puri-Filter" is the ultimate in turbine or engine oil lubrication purification.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

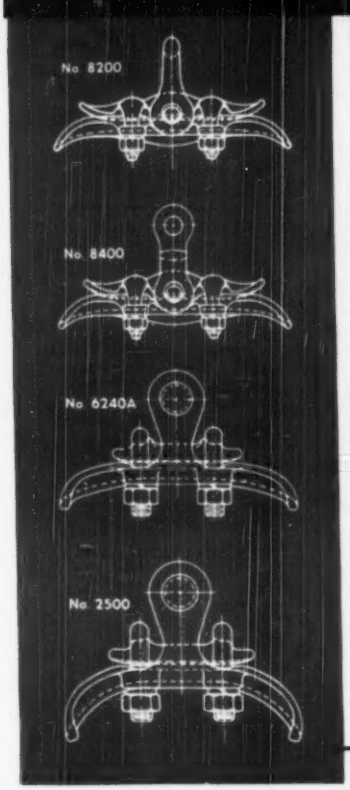
DE LAVAL
OIL PURIFIERS

for most dependable power production



BTC... the complete line

GROUND WIRE SUSPENSION & STRAIN CLAMPS



Drop Forged Steel Ground Wire Suspension and Strain Clamps are an essential part of the **complete line** produced by BTC.

Designed for application on all types and sizes of Ground Wires, they feature more than adequate ultimate strength and holding power. Several sizes are available in each design for proper fit on cables with or without armor rods.

SERIES 6200A ENVELOPE TYPE SUSPENSION
For normal line angles.

SERIES 2500 LARGE ANGLE ENVELOPE TYPE SUSPENSION
Makes unnecessary the use of two regular Suspension or Strain Clamps on corner construction.

SERIES 8200 AND 8400 TRUNNION TYPE SUSPENSION
Designed to greatly reduce the effects of vibration on highly stressed cables.

NO. 5030 STRAIN CLAMP
Efficient, economical design for all but the heavier construction.

NO. 5050 TRUNNION TYPE STRAIN CLAMP
Heat-treated parts for increased strength — serrated clamping surfaces for improved holding power.

Flexible attachment of Ground Wire Clamps to towers is desirable. **The BTC complete line** includes a number of standard Shackle, Link and Clevis designs ideal for this purpose.

BTC'S NEW HI-LINE CATALOG, showing its complete line of transmission line hardware, is available on request. Write for your copy today.

Sold only through your insulator manufacturer

THE BREWER-TITCHENER CORPORATION, Cortland, N. Y.

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CHEVROLET *ADVANCE-DESIGN* TRUCKS

You're right in every way when you choose Chevrolet trucks as your on-the-job partners. Chevrolet offers you more—in power for the job, economy of operation, low maintenance costs.

Economy-wise—you're right in choosing Chevrolet. You save money, for Chevrolet is the lowest priced line of all. And you save on gas, oil and upkeep with these trucks so famous for all-around economy.

Power-wise—you get more with Chevrolet, too. Chevrolet's great valve-in-head engine is the result of 38 years of steady improvement—an engine that offers outstanding pulling power combined with dependability and long service at low cost.

Job-wise—you're right with Chevrolet. There's a Chevrolet truck to fit *your* job . . . with the right power, the right clutch, the right power-train to fit the need. And every unit of the Chevrolet truck you select is *engineered* for the job. Yes, to *do* your job right—with outstanding efficiency and economy.

Before you buy, get all the facts on Chevrolet—first-cost, operating cost and maintenance cost. Remember: For the last eight consecutive truck production years, users have purchased more Chevrolet trucks than any other make. See your local Chevrolet dealer now!

CHEVROLET MOTOR DIVISION, *General Motors Corporation*, DETROIT 2, MICHIGAN

CHEVROLET

First in demand
First in value
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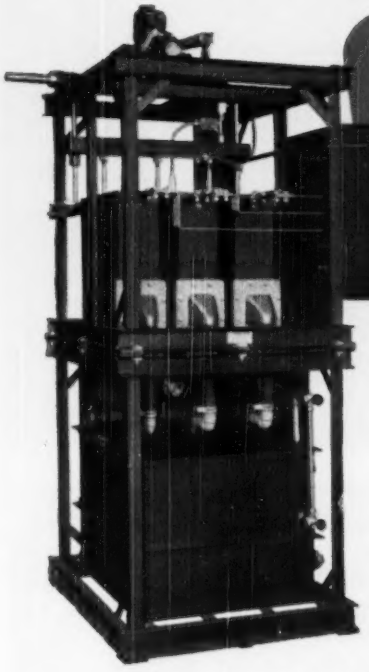
Only Chevrolet Trucks Give You All These Advance-Design Features:

• **TWO GREAT VALVE-IN-HEAD ENGINES: the 105-h.p. Loadmaster or the improved 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load** • **POWER-JET CARBURETOR—smoother, quicker acceleration response** • **DIAPHRAGM SPRING CLUTCH for easy-action engagement** • **SYNCHRO-MESH TRANSMISSIONS for fast, smooth shifting** • **HYPOID REAR AXLES—for dependability and long life** • **DOUBLE-ARTICULATED BRAKES—for complete driver control** • **WIDE-BASE WHEELS for increased tire mileage** • **BALL-TYPE STEERING for easier handling** • **UNIT-DESIGN BODIES—for greater load protection** • **ADVANCE-DESIGN STYLING for increased comfort and modern appearance.**

Stepless Speed Control of Boiler Draft Fans...



ALLIS-CHALMERS

Type 257 Liquid Rheostat

POWER PLANT CONTROL

DRAFT FANS operate at exactly the speed your boilers require for perfect combustion when Allis-Chalmers Type 257 Liquid Rheostats are used with a wound rotor drive motor. The right draft for any combustion condition is provided automatically by the wide range stepless speed control of these liquid rheostats.

They can be used with electrical, pneumatic or hydraulic pilot devices. Type 257 Liquid Rheostats have few moving parts, no arcing contacts, no mechanical connections to either fan or motor. This simplicity of design adds up to little or no maintenance.

You can keep the valuable floor space of your motor room free of bulky speed control devices by using Allis-Chalmers Type 257 Liquid Rheostats. Not only are they compact in size, they can be placed anywhere . . . even outside of the motor room. Call your Allis-Chalmers representative or write for leaflet 14S7544.

A-3223

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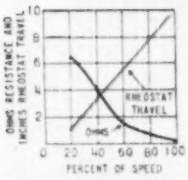


Type 257 Liquid Rheostats are "application engineered" to give straight line speed characteristics.

ALLIS-CHALMERS

ORDER TELEGRAPH SYSTEMS

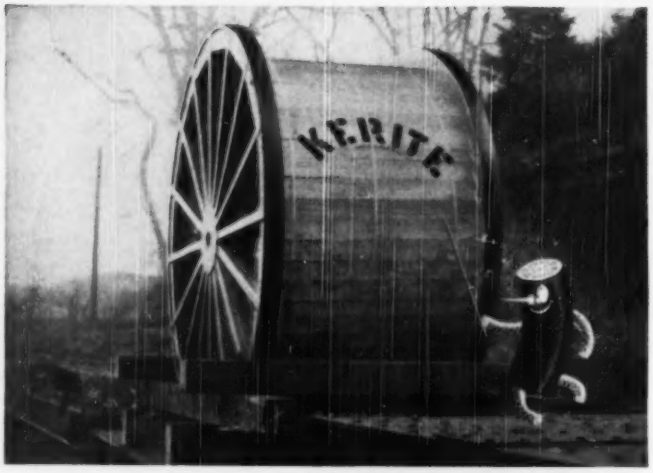
The Allis-Chalmers Order Telegraph System is accurate and reliable . . . can be depended upon even during station power failure because it uses the dc bus for its power source. An alarm system operates until the order is returned correctly. Select either five or ten inch semi-flush dials. Use it to transmit orders between switchboard and turbine room.

WOUND ROTOR PRIMARY MOTOR CONTROL

Make your Boiler Draft Fan Drive all Allis-Chalmers. Use the Type 257 Liquid Rheostat for secondary speed control, an Allis-Chalmers Type "H" Starter for primary control (bulletin 14B6410A), and an Allis-Chalmers wound rotor motor.

Proper Handling

PROTECTS THE LONG LIFE INHERENT IN KERITE CABLE



THE EXCELLENCE that is designed and built into Kerite Cable is protected by great care in handling at all times.

Unusual precaution and care in all stages of manufacture, constant checking and rechecking, sound methods of preparation for shipment . . . all make certain that Kerite's quality is preserved for the ultimate user.

Fine engineering, conscientious workmanship, and proper handling combine to protect the long life that is inherent in all Kerite Insulated Cable.

Kerite engineers will be glad to help you with your cable problems, whatever they may be.

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Offices also at 122 S. Michigan Avenue, Chicago; 582 Market Street, San Francisco; 714 W. Olympic Blvd., Los Angeles.

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KERITE CABLE

Kerite Insulation—Your Cable's Best Life Insurance

Whence the Direction?

Electric utility stabilization of manpower has been very well achieved—maybe too well. During a 25-year period when capacity increased 136% the employees increased only 16%. The trend is conducive to efficiency, economy, and contentment but is it conducive to future security?

Certainly not if the turnover by resignation, retirement, and death is as small as it appears to be. The immediate consequence is a steadily rising average age and homogeneity of age in the upper brackets of administration. One route of escape is by picking young men and skipping those next in line on a seniority basis when filling top vacancies. They in turn have the same problem in filling the intermediate berths and so on ad infinitum. Before they have gone far they encounter a dearth of talent that signifies only one thing—not enough new blood at the bottom levels.

When the seriousness of this is sensed the recruiting of cadets starts with the customary assumption that the technical schools will supply the need for engineers without much effort.

To assume that the supply is and will be ample is to make a bad mistake. First, the percentage of high school graduates who have gone into engineering has dropped from 5.3 in 1947, to 4.0 in 1948, to 2.9 in 1949, and to 2.2 in 1950. That is then the really critical level to which effort should be directed. Second, college statistics and those of the ASEE show that there will be hardly more than a third as many engineering graduates (12,400) in 1954 as there will be (32,500) in 1951. If the draft takes engineering students the 1954 crop may be much less than 9,000.

Those 9,000 will be in demand by industries that can often make more lucrative offers than can the regulated utilities. Competition can thus shrink the potential supply for utility engagement from 32,000 to 3,000 or even less.

What can the utilities be doing right now to counteract this dim trend? There are several things:

1. They can help all industry prove to faculties and high school graduates alike that engineering is a fruitful and stimulating profession.
2. They can help the electrical segment of industry prove that electrical engineering has as much glamour and promise as aviation or chemical engineering.
3. They can help the power segment of the electrical industry demonstrate that power engineering can have just as much allure and return as can the electronic segment.
4. They can help by supplying research tasks and fellowships for the advanced engineering students.
5. They can help by collaborating with the undergraduate faculties in lectures, literature, plant visits, loaned personnel, scholarships, etc., to enliven the power courses so prone to be called dull. Summer employment of teachers is a good move.
6. They can help by hiring more of the recent graduates and encouraging them so they can be points of infection for ensuing classes.
7. They can help by setting up much better cadet courses to train these men not only by indoctrinating them into current practice but giving them the evolution of those practices through discussion of prior art.

Implementation can take other directions. But unless some of these moves are made promptly there may not be any qualified talent to acquire for several years. Can the industry that is destined to triple in 15 years take that chance?

Let Vepco Build Roanoke Rapids

The inconsistency of Interior Secretary Chapman in urging more power for national security on one hand and bitterly contesting before the Federal Power Commission the license applications of private electric utilities on the Kings and Roanoke Rivers on the other was pointed out in ELECTRICAL WORLD'S Washington Comment column on Oct 9. Now, we're gratified to see that this has been formally pointed up in the new supplementary decision on Roanoke Rapids, issued Nov 15 by FPC's chief presiding examiner, Frank A. Hampton.

Hampton, for the second time within nine months, recommends that the commission license Virginia Electric & Power Co to develop a hydroelectric project at Roanoke Rapids. Taking note of new developments since his first decision last spring, the examiner declares:

"In the present grave emergency, the government looks to private industry for cooperation and support and, where practicable, for increased investment of private capital for the immediate strengthening of the national economy and security. In this case, an experienced and successful private utility company is ready, willing, and able to proceed under federal license and regulation with the development and utilization of idle and wasting natural resources at Roanoke Rapids without aid of the Federal Treasury and substantially in harmony with the Army's comprehensive plan."

A significant footnote to the decision includes excerpts from Chapman's statements on the need for more power for security, made to the first meeting of the Electric Utility Defense Advisory Council, Oct 19.

It's clear that one method of achieving more power would be to encourage such private developments as Roanoke Rapids. We hope that the commission will not long delay in approving the examiner's decision on Roanoke Rapids. We further hope that the commissioners will reaffirm their own decision of a year ago in licensing private development of the Kings River.

And, for that matter, we suggest that Secretary Chapman might lend more weight to his conciliatory words by withdrawing his opposition to those promising private power projects.

Principles of Sound Management

A formula for successful operation of municipal utilities was presented by F. Ford Northrop, president of the Northwest Public Power Association, at the dedication of the Springfield, Oregon, municipal system. We believe that many old as well as new systems would profit by the sage advice given in his ten points. Six of the most significant are as follows:

There must be a type of management organization that can operate in an independent manner, free from political interference.

The utility must be operated like a business. Charges must be made for all services rendered by the utility, and the utility must pay for all services it receives. These include dealings with other departments of government.

The charges and rates for service must be fair and equitable, without favor to special classes of customers, or to special uses by customers.

Operation should be on a pay-as-you-go basis as far as possible. There should be an effort to end each year with a surplus, to be used for payment of debt and to provide money for new construction.

Proper amounts of income should be placed in a depreciation fund to provide for the replacement of worn-out and obsolete equipment and properties.

Capable employees must be obtained. They must be paid wages that are commensurate with the services they render.

Fact Finder

The extent to which facts about the electrical industry are being distorted by some public power enthusiasts is appalling. Such activities require unending counter measures at the local level by all those who are able to stand on their feet and talk or sit down and write.

A new tool for furthering these counter measures has been developed for the Electric Companies Public Information Program by Bozell & Jacobs Inc. This tool is a book called *Fact Finder*. It contains 85 pages of tables, charts, maps, and facts on the electric power industry. Data on federal, municipal, co-op, and investor-owned systems are included. It is a timely addition to the PIP program.

Fluorescent Street Lighting in Canada?

While we in the United States are carefully feeling our way toward common application of fluorescent street lighting, it is possible that our Canadian cousins will step out ahead of us. Such a possibility is contained in the words of Leslie Gamage, vice chairman of the General Electric Co, Ltd (a British concern not related to General Electric Co in the U.S.). Gamage talked to newspaper reporters in Toronto recently. He said his company is "jumping into the Canadian market with both feet" and intends to put heavy emphasis on street lighting.

The story goes that C. E. Wilson, president of U. S. General Electric, returned from England a year or so ago all steamed up about progress in fluorescent street lighting there. That is said to be the reason the street lighting department at the Lynn works accelerated its development and promotion of fluorescent lighting and is going strong on the job today. Putting this story and the Gamage announcement together suggests that perhaps our engineers will be crossing the border some time in the future to see how Canadian cities look under fluorescent street lighting.

The Electrical Week

IN WASHINGTON—An explosion in the Bethesda, Md., substation of Potomac Electric Power Co early Nov 25 caused outages for nearly ten hours in several Maryland suburbs of Washington (p 90) . . . The Atomic Energy Commission is making studies to determine whether it will purchase power or generate its own for the new H-bomb plant in southern South Carolina (p 90) . . . An agreement approved Nov 16 between Interior's Petroleum Administration for Defense and the National Production Authority may provide a pattern for a similar pact between NPA and DPA (p 92) . . . Class 1 electric utilities have received forms for reporting 1950 use and 1951 estimates of aluminum, steel, and copper to DPA (p 93) . . . Virginia Electric & Power Co has asked FPC to set early argument on its license application to construct a hydro project at Roanoke Rapids (p 95).

ELSEWHERE—Nature in the form of wind, rain, snow, sleet, and floods crippled the nation's utilities on Nov 25, leaving 3 million customers without power (p 88) . . . Pacific Gas & Electric Co weathered record floods in California but had 460,000 kw off the line at one time (p 89) . . . Eight Hollywood stars and their wives have joined a campaign of EEI to promote the sale of electric ranges during the coming year (p 91) . . . The whole world depends on American productivity, C. H. Lang, vice president, General Electric Co, told the Chicago Regional Power Conference Nov 17 (p 92) . . . A report warning that excess profits tax legislation might make rate boosts "mandatory" for electric and other utilities was adopted by the 62nd annual convention of NARUC in Phoenix, Ariz., Nov 13-16 (p 93) . . . And Don Mackie, Commonwealth Services, Inc., asks if the effort to glamorize annual reports is overshooting the runway when the message lands (p 94).

• • •

Edward W. Morehouse, vice president of General Public Utilities Corp, has been offered the position of defense power administrator by Secretary Chapman.

Excess profits tax has lost support in Washington since the election, but it's still a better than even bet that there will be an EPT early next year.

Interior's Defense Power Administration and Commerce's National Production Authority are not on the best of terms these days. DPA officials seek more exemptions from NPA orders for electric utilities. NPA officials think the exemption granted in the aluminum cutback may have been too generous because it opened the door for protests from other industries. And there's still the quiet but bitter feud over who is to control production of generating equipment. National Security Resources Board Chairman Symington will have to settle these squabbles.

At least 30 different kinds of lights are used for street lighting in New York City. They range from 10-w to 1,100-w.

Budget Bureau Director Frederick J. Lawton has asked federal agencies to submit for bureau approval proposals for publication of statistical information which may involve national security. It's not clear whether any power statistics will be curtailed under the new program.

Notes From The News

The main flow of the Columbia River was diverted at McNary Dam, Ore., Nov. 17 when the last of a number of 12-ton tetrahedrons was dropped into place to fill a 240-ft section of the river. With the main volume of water directed to the Washington side, the Oregon side is ready for powerhouse construction . . . Mechanical failure of a generator caused the postponement of dedication ceremonies at the Bureau of Reclamation's Anderson Ranch Dam and power plant. The dedication was originally scheduled for Nov. 20. A new date will be set as soon as the extent of the repair work can be determined . . . Tennessee Valley Public Power Association's Electrical Exposition has ended a six months' tour of Alabama, Kentucky, Mississippi, and Tennessee. Show was seen by 370,000 and traveled 3,000 miles . . . The vice president of British Columbia Electric Co, Thomas Ingledow, has warned that Vancouver Island is nearing the end of its hydroelectric resources and may have to resort to fuel-fired plants in the future for its power. The warning was delivered at the opening of the utility's Glyn substation near Victoria . . . A new lake has been formed in the upper East Tennessee Mountains with the closure of South Holston Dam near Bristol, Va. The barrier is the largest earth and rock filled dam in the Tennessee Valley Authority's 28-dam system. It is 1,600 ft long and rises 285 ft above the bed of the south fork of the Holston River in Sullivan County . . . The County Court at Champaign, Ill., has dismissed legal objections to a street lighting project in southwest Champaign. Home owners who object to brighter street lights have filed notice that they will appeal the matter to the Illinois Supreme Court.

Nature Throws the Book at Utilities

Wind, Rain, Snow, Sleet, Floods Hit Eastern, Midwestern States; Storms, Termed by Many 'Worst in History', Deprive 3 Million of Power

Nature in the form of wind, rain, snow, sleet, and floods hit the nation's utilities on Nov 25. Dozens of utility public relations directors called the disaster "the greatest storm in the history of our company." That this was no understatement is evident from the estimated outages reported by the many companies surveyed. At the height of the storms close to 3 million customers were without power.

Western Pennsylvania, parts of West Virginia, and eastern Ohio suffered from snow 20 to 42 in. deep. Farther east sleet entered the picture. On the Eastern seaboard wind and rain did the damage. And along the rivers floods added to the havoc.

Work was speeded through use of two-way radio and by following prearranged disaster plans.

Financial loss will run into the millions; no company was willing to hazard a guess as to its loss. All agreed the figure would be high.

Statements of various utilities secured on the afternoon of Nov 28 follow:

Cleveland Electric Illuminating Co—Loss light because snow was dry and did not cling to lines. About 15,000 customers were affected, but none was industrial. Impassable streets were responsible for any delay in restoring service.

Dayton Power & Light Co—Little damage but crews extended themselves to restore service in rural areas. To reach tiny Terre Haute an Urbana crew used bulldozers to break through snow drifts 10 ft deep. Crew took from 7 AM to 10:45 PM to travel less than ten miles. In Cedarville section crews got farmers to put tractors on the road to help.

Duquesne Light Co—Despite 29-in. snow, no trouble. Load dropped sharply when steel mills stopped operating because of inability of workers to reach mills.

West Penn Power Co—Same situation as at Duquesne.

Pennsylvania Power & Light Co—Some 255,000 customers out, all but 45,000 back by Sunday morning, all back by Tuesday. Some 10,000 miles of line interrupted. Floods on the Susquehanna put the Williamsport Station out of operation. Used 2,000 employees, not all linemen, to restore operations and moved crews from division to division as needed.

Philadelphia Electric Co—Hit hardest in Bucks and Montgomery Counties, 45,000 customers out. All back by Tuesday morning. Contractors furnished crews, and 2,500 of company's employees were on the job.

Pennsylvania Electric Co—Ice and sleet storm in Altoona and Blair County worst in history of the company. All six transmission lines feeding Altoona are down. Restoration work greatly hampered by continued cold weather. Some 60,000 customers out Saturday of which half were still out Wednesday morning. Altoona business district where there is an underground distribution system was getting service Monday morning, but power supplies were limited. Lewistown was without service from Saturday evening until Tuesday morning. Huntingdon was also in bad shape. Juniata River went over its banks. Riverside substation was covered by 11.5 ft of water. This caused the interruption to Lewistown service. Every lineman who could be used was secured. 25 outside crews were on the job. It may take another week to get system operating.

Metropolitan Edison Co—Lost 73,000 customers in its three divisions. Western Division at York made the quickest recovery, all customers back by Monday morning. Hanover and Gettysburg were without power for four hours Saturday morning. Yorkhaven hydro plant, 19,000 kw, was flooded out. Central Division at Reading was hit hard; winds reached 85 miles an hour. TV antennae caused considerable trouble. Poles were not toppled but were snapped in the middle. Eastern Division hardest hit. Suspension bridge for foot traffic in Easton was dropped, carrying with it two transmission lines from Easton plants. In Pocono area steel-frame line from Belfast to East Stroudsburg was flattened. Trees were piled 10 ft deep on the right of way. Company lost 75 transformers over the system. Reading crews moved to Easton to help, and 75 men were hired from contractors.

New Jersey Power & Light Co—Lost 70,000 of its 80,000 customers, had all but 28,000 back Monday morning, and expected to have all back by Wednesday morning. Tide Water Power Co, and Virginia Electric & Power Co sent in some crews. Others were secured from contractors in Ohio. Many of these men were flown in. On basis of customers out, storm was worse than 1948 sleet storm.

Atlantic City Electric Co—Had 80,000 customers out, all but 5,000 back by Sunday noon, all back Monday morning. Contractors supplied 14 crews. Missouri Ave Plant out six hours because of flooded water feed pump. Deepwater Plant carried load without difficulty.

Jersey Central Power & Light Co—Had 115,000 of 165,000 customers out, 10,000 still out Wednesday morning. Most trouble in Morristown area where crews had to chop their way into the lines. Salt deposits on insulators caused many pole-top fires on Monday night. Crews were brought in from Chicago; St. Louis; Allentown; Pittsburgh; Detroit; Worcester, Mass; and Shenandoah, Va.

Public Service Electric & Gas Co—Had 375,000 customers out, 52,000 still out Tuesday midnight. Company had 2,500 men on the job. Consolidated of Baltimore sent in six crews, Boston Edison three, and Hartford Electric two. All sent trucks. Detroit Edison flew in two crews. Fourteen tree trimming crews were hired.

Rockland Light & Power Co—Reported heavy damage from fallen trees, 60 down in one half-mile stretch.

Winds of 93 miles per hour reported at system operators building at Middletown, N. Y. A quarter of all customers were out, 18% out Monday morning.

Central Hudson Gas & Electric Co—Had 45,000 customers out, practically all back by Tuesday night.

Long Island Lighting Co—Had 150,000 customers out, 100,000 back by Monday morning, 125,000 by Monday night, all but 15,000 by Tuesday morning. There were 6,000 wires down, 400 poles down and 1,000 leaning, and 1,000 trees across lines. Company had 2,000 of its own employees on job, and six crews were flown in from Detroit and Chicago areas.

Consolidated Edison Co—Lost 407,000 customers, all but 2,000 were back Wednesday morning. System peak Saturday was 300,000 kw less than previous Saturday. When storm broke all employees of meter, sales, and engineering departments were mobilized. Some patrolled the system in their own cars to spot damage, 400 patrolled on foot.

Staten Island Edison Co—Had 40,000 of 56,000 customers out, practically all back Wednesday morning. Generating stations had trouble because of flooded motors. No power shortage resulted because of tie line with Public Service Electric & Gas Co.

Westchester Lighting Co—Had 50,000 customers out, 2,840 still out Wednesday. Trees caused a lot of trouble, and eight tree trimming crews were hired. Winds at control station registered 90 mph.

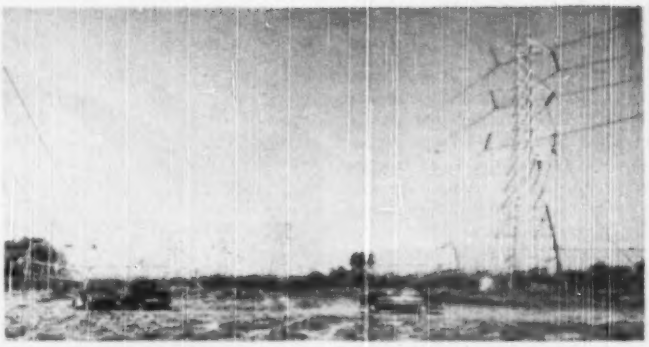
United Illuminating Co—Had about 60,000 customers out, all but 3,000 back by Tuesday evening. Nine outside crews were brought in.

Connecticut Light & Power Co—Had about 70,000 customers out, 500 were still out Tuesday evening.

Hartford Electric Light Co—Lost less than 10% of its customers, and all were back by Sunday night. Bloomfield and East Hartford were out at height of storm. Company sent crews to help elsewhere.

Boston Edison Co—Lost 40,000 customers, but all were back in 30 hours.

Public Service Co of New Hampshire—Lightly hit, practically all customers had service Monday evening.



TWO OF FOUR TOWERS lost near Sacramento by Pacific Gas & Electric. Tower down at right is a single circuit 165-kv line from Caribou, while one at left is a double circuit 220-kv from Big Bend. Note badly bent tower at extreme right

Pacific G&E Co Loses 460,000 Kw of Capacity When Floods Hit System

With eight hydro plants knocked out and service from another five largely cut off by washed-out transmission towers—a total loss of 460,000 kw—Pacific Gas & Electric Co weathered record floods in California Nov 19-22 with a 362,000-kw margin.

Week-long rains, up to 17 in. in parts of the Sierra, combined with runoff released by unseasonally high temperatures, filled valley rivers to record heights.

The Corps of Engineers estimated total damage to be between $20 and $25 million, and a PG&E spokesman estimated damage to its system at $750,000.

Power houses of PG&E out of service for extended periods of time were Bullards Bar and Colgate on the Yuba River, American River and Spring Gap on the American River, Electra and West Point on the Mokelumne, and the Tule River and Kern Canyon Plants. For five days output at the utility's Feather River system was largely cut off because of tower failures near Sacramento.

Other plants which were shut down for shorter periods of time included Crane Valley and Wishon on the San Joaquin River, the Folsom Plant on the American, and the Drumm on the Bear River.

Most severe damage occured at the American River Plant as flood waters washed out a 175-ft-long rock-fill head dam. Generaters were flooded by 3 ft of water on the plant floor. At the Kern Canyon Dam the wooden bridge across the head dam was washed out, carrying the gate controls with it.

The Tule River Plant was expected to be down for several weeks because of debris-damaged transformers, wet generators, and damage to the head dam structures. Spring Gap went out because of a canal washout, and the Colgate Plant went down when its grizzly was damaged by debris and shoved down a tunnel. The Electra and West Point Plants shut down when tunnels had to be closed because overflowing tailraces threatened debris trouble. Water filled the cooling water pump at Electra with sand. Distribution outages in the PG&E system were confined mainly to those communities which were seriously flooded.

Water conservation experts, meanwhile, saw a bright side to the storm clouds. Several predicted that the overall benefits of the storms would exceed the damage caused.

Sampling five areas, PG&E found that water storage had been upped some 110%. In these areas—Turlock and Merced irrigation districts, Friant Dam, Bass Lake, and the Southern California Edison Co storage on the San Joaquin—the pre-storm storage total was 339,324 acre ft. After the storm it had reached 739,478 acre ft. Friant Dam alone added 75,000 acre ft, and Shasta added 55,000 acre ft. Most of the 122 PG&E reservoirs were reported to be storing at maximum capacity.

Pepco Substation Blast Causes 10-Hour Outage

An explosion in the Bethesda, Md., substation of Potomac Electric Power Co early Nov 25 caused outages for nearly ten hours in several Maryland suburbs of Washington, D. C. It came during the capital's coldest weather of the year, with rain and snow storms accompanied by high winds.

Company explanation of the cause of the explosion is that the wind blew conductors against a 13-kv feeder line near the substation. The circuit breaker opened and reclosed letting some vaporized oil escape into the room on the second floor of the substation. This happened a number of times within a few hours. Then lightning struck, near the substation, and ignited the vaporized oil.

The blast tore out the thick brick wall on the second floor of the $500,000 substation and damage was estimated at $200,000. Two large transformers and other equipment were not damaged. The lone occupant of the building had been busy all night on interruptions caused by the frequent line shorts and failures. He escaped injury by diving under a table.

The outage occurred at 5:28 AM. Service was not fully restored in some suburban areas until 3:30 PM.

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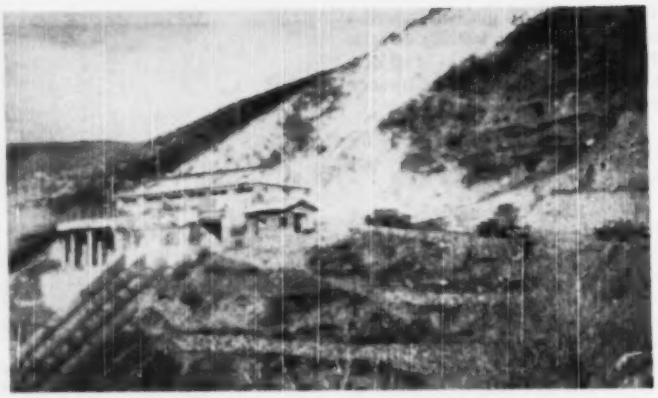
Ohio City to Sell Plant; Clyde Plans Expansion

Berea, a suburb of Cleveland, has voted to sell its municipal light and power plant for not less than $800,000. Cleveland Electric Illuminating Co, which has been bidding for the property for the past several months, is expected to acquire it. Proponents of the sale stated that it would be necessary to spend $2 million to modernize the plant to serve the growing community. Opponents contended that the present replacement value of the plant is $1.5 million.

Another Ohio community, Clyde, has decided to improve and expand its municipal electric system, more than doubling its present capacity. The village will issue $470,000 in mortgage revenue bonds to finance the program. Plans include installation of two dual fuel diesel generating units, each with a capacity of 1,250 kw. The plant now has a capacity of 2,000 kw.



U. S. MARINE vehicles approaching the last of four hydro plants south of Changjin Reservoir. The plant was seized virtually intact and left marines in sight of the vital Changjin installation, main source of power in northeast Korea

H-Bomb Project in South Carolina May Get Power from Sepa Plants

The Atomic Energy Commission is making studies to determine whether it will purchase power or generate its own for the new hydrogen bomb plant in southern South Carolina.

The Department of Interior's Southeastern Power Administration, however, is likely to be called on to supply at least some of the new plant's power. First units will be installed at Clark Hill Dam on the Savannah River near the new project in 1952. Clark Hill, under construction by the Corps of Engineers, will have an installed capacity of 280,000 kw by 1954.

Another Savannah dam from which power will be marketed by Sepa is Hartwell. Hartwell, which will be constructed by the Corps of Engineers, will have an initial installed capacity of 90,000 kw and an ultimate capacity of 177,300 kw. First power is due in 1953.

Two other Corps-Sepa projects in northern Georgia also will be able to supply some power for the atomic project. Allatoona now has 74,000-kw installed capacity with an ultimate capacity of 110,000 kw, and Buford, scheduled to come in during 1955, will have an initial installed capacity of 43,000 kw with an ultimate capacity of 86,000 kw.

By the end of 1954, Sepa will be marketing the 480,000 kw from three dams within the area of the new site. Another 173,300 kw could be installed within a few years after that. This new federal hydro is expected to figure importantly in the power studies AEC is now making.

A speed-up may be sought for the Georgia-South Carolina power projects to bring them in sooner, if the new plant's requirements begin to soar within a year or so.

Officially known as the Savannah River Plant, the new AEC project will be built and operated by the E. I. du Pont de Nemours Co. It will consist of some 250,000 acres in Aiken and Barnwell Counties, South Carolina, on the Savannah River which forms the boundary between South Carolina and Georgia. The site is 15 air miles south of Aiken, S. C., and 20 air miles southeast of Augusta, Ga.

Both Clark Hill and Hartwell are north of Augusta on the Savannah River, while Allatoona on the Etowah and Buford on the Cattahoochee River are north and west of the new atomic project site.

Construction at the new site will begin early next year with funds from a $260 million supplemental appropriation approved by Congress last September.

AEC emphasized that it has effective radiation protection measures, and

that no atomic weapons will be manufactured at the site. Atomic materials produced there will be shipped elsewhere for weapon-making and testing, it was announced.

The new site was chosen by du Pont and AEC engineers after considering more than 100 proposed locations. An AEC site review committee of private engineers approved the selection.

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Customer Relations Guide Outlined to N. J. Group

Three basic factors which would serve as a guide for standards of customer service to meet the needs of the future were listed by Henry R. Flanegan, Philadelphia Electric Co, at the annual meeting of the New Jersey Utilities Association Nov 17 at Absecon.

"Because we have been concerned about customer relations," the assistant manager of the Customer Service Department of the utility said, "we may take too much for granted. Actually we must set a new standard because there are new conditions. We must remember that all our publicity and public relations efforts to safeguard the private enterprise system are predicated on a standard of service that no competitor for the operation of our business can provide."

To back up this thesis, he recommended: 1. High quality of physical service to the customer, 2. an absolute square dealing organization for customer relations, 3. personalized customer treatment whenever and wherever customers deal with employees.

Bernard Vonnegut, General Electric Co, stated that dry ice seeding of clouds is most suitable for causing a single storm in a small area. Silver iodide applied from the ground, he said, may produce storms over a much wider area. Since the rain may affect another area, such seeding may have to be regulated by the government. Furthermore, he pointed out, that once the clouds have been seeded, the precipitation cannot be controlled. This could lead to international complications as well as to local damage suits.

BAYARD L. ENGLAND, left, president of the Atlantic City Electric Co, is congratulated on his election to the presidency of the New Jersey Utilities Association by his predecessor, Franklyn Heydecke, retired comptroller of Public Service Electric & Gas Co, Newark

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Court Decision Upheld

Maryland's Court of Appeals has ruled that it has no authority to disturb the 110-kv power line built by Consolidated Gas, Electric Light & Power Co of Baltimore through the Greenspring Valley. In its fourth decision in the eight-year contest, the court held that the Circuit Court for Baltimore County has final authority in zoning cases within its jurisdiction. Property owners had protested the overhead construction.

THE CANTORS, Eddie and Ida, express their satisfaction with their electric range as well as with the food cooked on it. The Cantors are one of eight Hollywood couples appearing in the "Range of the Stars" advertisements

8 Hollywood Stars to Aid EEI to Push Range Sales

Eight Hollywood stars and their wives have joined a campaign of Edison Electric Institute to promote the sale of electric ranges during the coming year. The couples will be featured in a series of eight advertisements whose general theme will be the "Range of the Stars; of course it's electric." The campaign will be launched next week in New York.

The eight actors are Gene Autry, Jack Benny, Eddie Cantor, Broderick Crawford, Bob Hope, Alan Ladd, Pat O'Brien, and Robert Young.

Each of the ads will feature one of the couples, give a favorite recipe of the star, and will list eight good reasons why everyone should have an electric range. The eight reasons are better cooking results, it's clean, it's thrifty, it's automatic, it's easy to use, it's cool, it's fast, and it's modern.

Material being prepared by EEI includes newspaper mats, radio spot announcements, TV material, window and interior displays, a recipe booklet including the recipes given in the ads, and other material.

The campaign has been in the planning for some time, and EEI decided to go ahead with it despite rearmament when manufacturers indicated that ranges would be available.

GROVER C. NEFF, center, president, Wisconsin Power & Light Co, poses with T. B. Ellis, left, and C. H. Lang, right, both of General Electric Co. The three were participants in the recent Chicago Regional Power Conference sponsored by GE

Productivity Emphasized at Chicago Conference

The whole world depends on American productivity, which means hope in time of war and well-being in time of peace, C. H. Lang, vice president, General Electric Co, asserted at the Chicago Regional Power Conference Nov 17 sponsored by GE's Apparatus Department. With our newly expanded facilities, he said, we are prepared to produce, if necessary, fully twice as much as we did during World War II.

Heart of the problem of productivity, said W. T. Reace, Commonwealth Edison Co, is increased electrification of industry. Bringing more power to America is a challenge to both the electrical manufacturer and the public utility. Though their fields are entirely different, their interdependence requires that they work in unison like two oars of a rowboat if they are to go steadily forward.

Close cooperation among manufacturer, distributor, dealer, and utility in the development of advertising campaigns and in efforts of every kind to inform the ultimate user of the advantages of electric service was urged by Grover C. Neff, president, Wisconsin Power & Light Co. He also discussed public power attacks on the utility industry, calling attention to the fact that when only 50% of the people vote slightly more than 25% of the population can fix the nation's policies.

E. P. Berg, general manager, Pershing Road Plant of Link Belt Co, told the conference that industry expects the electric utility to provide (1) expert rate consultant service, (2) technical assistance in plant rearrangements and expansions, (3) applications engineers to supervise installations, (4) operating engineers to instruct operators on use of equipment, and (5) new equipment more promptly and maintenance of adequate stocks of repair parts.

Present trends indicate a 15-year industrial growth in the next five years, F. W. McChesney, Industrial Divisions, General Electric Co, said. He predicted expanded use of electricity in industry.

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Workers Granted Raise

A five-member arbitration board has awarded about 975 operating employees of Toledo Edison Co a 5% wage increase retroactive to June 1. The raise amounts to approximately 8¢ an hour. The findings are binding on both the company and Local 245, International Brotherhood of Electrical Workers, AFL. The union had originally asked for an increase of 20¢ an hour.

Petroleum Agency, NPA Work Out Agreement

An agreement approved Nov 16 between Interior's Petroleum Administration for Defense and the National Production Authority may provide a pattern for a similar pact between NPA and the Defense Power Administration. Negotiations for a formal working agreement between DPA and NPA have been held up pending the PAD agreement.

Here are the main points in the PAD-NPA memorandum of agreement:

1. PAD will serve as claimant agency at NPA for the petroleum and gas industries, and NPA will not exercise jurisdiction over these industries.

2. PAD will make decisions on distribution of materials within the petroleum and gas industries after allotments by NPA. To the fullest extent feasible, NPA will delegate to PAD the authority to administer regulations and orders relating to petroleum and gas.

3. Special arrangements may be made delegating authority to PAD in case of equipment or raw materials used primarily by the petroleum or gas industries.

4. PAD may delegate authority to NPA to control distribution of certain petroleum or gas materials.

5. NPA and PAD will maintain close liaison in the development of policies, programs, and procedures.

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250-Kv Transmission Line Is Nearing Completion

Final sections of the second 250-kv transmission line across the Cascade Mountains from Grand Coulee Dam to Snohomish, Wash., are being completed by the Bonneville Power Administration. Energization is scheduled for Dec. 1.

The line will permit an increase in power to the Olympic Peninsula and the Puget Sound area from about 225,000 kw to 400,000 kw. Service stability will be added by providing an alternate circuit from Grand Coulee to western Washington, and heavy overloads on the Grand Coulee-Midway and Covington line will be substantially relieved.

Approximate cost of the line is $3,170,000 while terminal facilities at Snohomish involve another $180,000.

NARUC Hits Excess Profits Tax, Warns Rate Boosts Would Follow

A report warning that excess profits tax legislation might make rate boosts "mandatory" for electric and other utilities was adopted by the 62nd annual convention of the National Association of Railroad and Utilities Commissioners held in Phoenix, Ariz., Nov 13-16.

Upholds Power of Commissions

The report, prepared by a special committee headed by Justus F. Craemer of California, was presented before the House Committee on Ways and Means in Washington on Nov 22. "Regulatory commissions," the NARUC report said, "should be continued in their duty and their right to determine what constitutes excess profits in each case, and have conclusively proven that they may be relied upon to discharge their duty to prevent excessive profits by regulating the selling prices of public utility services."

Declaring that an excess profits tax might pose "unmanageable problems" to regulatory commissions, the report pointed out that general utility rate increases would "certainly tend to increase the already dangerous inflationary trend, a trend which has thus far been resisted to a greater degree by the public utilities than by any other group."

Asks More State Authority

The association also took a firm stand for greater powers for state authorities regulating utilities. This situation, as it applies to electric utilities, was particularly stressed by Harry M. Miller, member of the Ohio Public Utility Commission and outgoing association president. He stated that federal commissions have usurped powers that belong to the states and cited two examples that apply to Arizona utilities. Both Arizona Edison Co and the Central Arizona Light & Power Co, operating entirely within the state, recently were declared by the Federal Power Commission to be public utilities engaged in the transmission of electrical energy in interstate commerce, and, therefore, subject to regulation by the FPC.

The contention is based on the fact that the two utilities purchase supplemental power from California generating plants. "Certainly this situation never was contemplated by the state commissioners," Miller said.

Other NARUC resolutions proposed amendments to the Johnson Act and the Natural Gas Act, and a study of the rules of practice and procedure of state commissions to arrive at a uniform set of rules. The purpose of amending the Johnson Act is to make sure that U. S. District Courts cannot suspend or restrain any decisions of state regulatory commissions unless there is interference with interstate commerce.

Proposed amendments to the Natural Gas Act call for state regulation of companies doing business entirely within that state's borders. It is believed that the FPC should have no control in such cases and that a company should not be considered as being engaged in interstate business if it taps an interstate gas line.

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5,000-Kw Unit Planned

A 5,000-kw turbine will be added to the municipal power plant at Lamar, Colo. A new condenser and boiler also have been ordered for the plant.

MAJ GEN EVERETT S. HUGHES has succeeded Edward Falck as director of the Office of Energy and Utilities of the National Security Resources Board

Utilities Get DPA Forms to Report Use of Metals

Class I electric utilities last week received forms for reporting 1950 use and 1951 estimates of aluminum, steel, and copper to the Defense Power Administration.

Returns from the survey will be used by DPA in preparing estimates of the electric utility requirements of the metals for the final three quarters of 1951. The estimates will be presented to the National Production Authority which will assign a quota of each metal to the electric utility industry.

In a letter accompanying the reporting forms, the acting administrator for electric power, D. L. Marlett, emphasized that the new forms will not be used for distributing materials within the industry.

Supplies of materials under control for use in larger construction jobs will have to be justified on individual project application forms which are now being prepared, Marlett explained.

The acting administrator warned against duplication of requirements in the case of alternate metals "or any other inflation of estimates."

Aluminum returns were requested by Dec 11, and DPA expects to make its aluminum estimates to NPA in January. Quota assignments for aluminum are expected by Feb 1.

The new DPA forms request estimates only for mill shapes and not for materials in fabricated equipment.

Returns are to be made to the Federal Power Commission which will process the reported data for DPA. Inquiries concerning the survey, however, should be directed to DPA.

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Con Edison Boosts Wages

Consolidated Edison Co of New York and the Utility Workers Union, CIO, recently signed an agreement providing wage increases of an estimated $8,250,000 for 1951. The increases are split into two sections. On Jan 1 company workers will have their hourly pay raised 10¢ an hour. On July 1 the rates go up another 5¢ an hour. In terms of payroll, this means a 6% rise in January and a 3% rise in July. Also under the agreement, maximum pay rates under the present company-union wage progression plan will go up 10%.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1950									
Nov. 22	2.65	2.67	2.79	3.81	4.05	4.47	5.85	6.71	7.45
Nov. 16	2.65	2.67	2.76	3.82	4.05	4.49	5.83	6.70	7.41
END OF QTR.									
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.05
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.32
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67
4th 1949	2.59	2.61	2.79	3.85	4.06	4.46	5.37	6.15	7.01

Data: Reis & Chandler, Inc.

Merits of Glamor in Annual Reports to Win Contest Prizes Questioned

Is the effort to glamorize annual reports overshooting the runway when the message lands?

Don Mackie, director of public relations for Commonwealth Services, Inc, has been doing some thinking about current trends in this field in an effort to find the answer to that question. He has turned up no final conclusions but a set of provocative questions.

Mainly Mackie wonders: Is the trend toward pictorial lavishness causing some to lose sight of the primary objective of an annual report? Has the contest idea encouraged this shift by stimulating eagerness to produce a publication for show purposes? Other utility men, independent accountants, and financial news men are beginning to pose similar questions at post-contest "Hot Stove League" sessions.

Real goal of the report, says Mackie, is to win people not prizes. Colored inks, pictures, charts, words, and figures in themselves do not create the desired effect. The test, he says, is whether the report helps set up an alternating current between employee, customer, and stockholder on the one side and management on the other. The publication should promote a practical working relationship based on mutual interests.

The key question, according to Mackie, in evaluating an annual report as in gauging the results of a power plant opening or other public relations activity is "What impression do you leave with the individual?" He would inquire, "Does your annual report simply smack the average person with an impressive inventory or overwhelm him with statistical description—or does it transform property and services into living assets that create an awareness of personal and community benefit? Does the end result leave one with a feeling of 'Ain't that something!'—which proves nothing—or an emotional reaction of 'I never thought of it that way before' "?

Mackie credits the recognized report contests with developing consciousness of a need for improvement over the past years. But, he questions, has the contest idea gone too far? Have the reports been judged on their ability to do a particular job for a particular company or by more superficial standards? Has an impractical burden been imposed on judges in the attempt to rate a report in terms of the company's own operating or financial conditions?

What recognition should go to the modest presentation of a small utility that may be maintaining an outstanding program of stockholder and public relations yet whose report is overshadowed by the brilliant publications of large companies? Which should be judged the better, a professionally executed institutional campaign of an abstract nature or the simply prepared entry of a small company that won a municipal franchise election? What weight should be given treatment of critical public issues such as the public vs private power controversy?

Maybe, Mackie admits, it is impossible to weigh all text in terms of editorial approach or presidential policy outline. But then, he asks, are reports judged as "best" or as "best looking"? Which is more important, what was said or how it was presented?

If the standards cannot be related to the problems of the individual company, merely citing first, second, and third may not mean a great deal. It might be more useful, to point out to unsuccessful entrants where, in the judges opinion, they were deficient.

FOR PRODUCING 'best' 1949 annual report from the standpoint of those interested in financial affairs, Virginia Electric & Power Co is winner of the bronze "Oscar of Industry" in the Southern utilities group and the silver one in the national utilities class of *Financial World's* contest. Above, Jack G. Holtzclaw, Vepco president, receives silver Oscar from Weston Smith, *Financial World*

Energy Sales in August 13.9% over Last Year

August electric energy sales were 13.9% above those for the same month last year.

In that month electric utilities sold ultimate customers 23,646,106,000 kwhr, compared to 20,758,404,000 kwhr in August, 1949. Revenue from ultimate customers totaled $421,089,900, which was 10.2% more than the $382,148,600 received in August of last year.

Classification of Sales, August

	Million Kwhr 1950	1949	Percent Change
Residential or domestic	4,964	4,422	+12.2
Rural (distinct rural rates)	867	873	−0.6
Commercial or industrial			
Small light and power	4,340	4,033	+7.6
Large light and power	12,172	10,120	+20.3
Street and highway lighting	218	202	+8.0
Other public authorities	587	592	−1.0
Railways and railroads			
Street and interurban railways	265	285	−7.2
Electrified steam railroads	188	185	+1.7
Interdepartmental	45	46	−1.9
Total to ultimate customers	23,646	20,758	+13.9

For the 12 months ended Aug 31 the average customer used 8.2% more energy than in the 12 months ended Aug 31, 1949—1,780 kwhr compared to 1,645 kwhr. The average annual bill rose 6% from $48.86 to $51.80, but revenue per kwhr declined 2% from 2.97¢ to 2.91¢.

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Vepco Asks Early Date for Roanoke Argument

Virginia Electric & Power Co has asked the Federal Power Commission to set early argument on its license application to construct a hydroelectric project at Roanoke Rapids. But the Department of Interior, which opposes the Vepco plant, is seeking a new time extension in the hotly contested case.

Oral argument within ten days of the Dec 5 deadline for filing exceptions to Examiner Frank A. Hampton's supplemental decision of Nov 15 (EW, Nov 27, p 13) was asked by the company. Hampton reaffirmed his earlier initial decision in favor of the license for Vepco.

Counsel for Interior and the Virginia REA Association have moved that an abbreviated record of the long proceedings be prepared before exceptions are filed. Their motion asks suspension of the 20-day deadline for filing exceptions to the examiner's decision.

They pointed out that the record in the case consists of more than 3,500 pages and about 100 exhibits. Merely reading the record, it is argued, "would be burdensome for the commission, and unnecessarily so."

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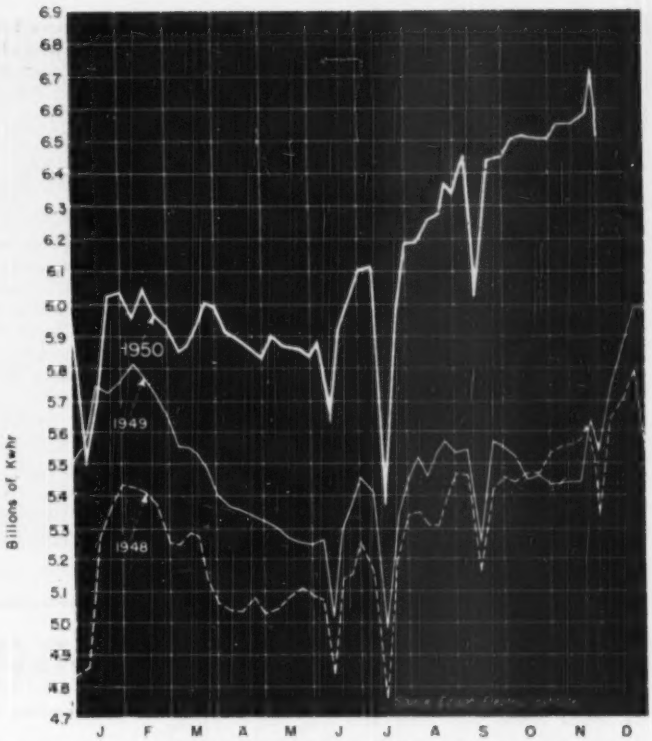
Municipal Raises Pay 5%

The Los Angeles Department of Water and Power has given its 9,680 employees a 5% pay boost. No employee is to receive an increase of more than $25 a month. For employees earning $300 a month the increase is about 8.6¢ an hour.



Output Week Ended Nov 25—6,507,509,000 Kwhr

Weekly Output, Millions Kwhr

1950	1949	1948
Nov 25 6,508	Nov 26 5,537	Nov 27 5,349
Nov 18 6,728	Nov 19 5,644	Nov 20 5,627
Nov 11 6,574	Nov 12 5,435	Nov 13 5,571
Nov 4 6,551	Nov 5 5,435	Nov 6 5,564
Oct 28 6,563	Oct 29 5,433	Oct 30 5,555
Oct 21 6,503	Oct 22 5,430	Oct 23 5,539
Oct 14 6,509	Oct 15 5,481	Oct 16 5,482
Oct 7 6,514	Oct 8 5,450	Oct 9 5,482
Sept 30 6,503	Oct 1 5,521	Oct 2 5,449
Sept 23 6,457	Sept 24 5,556	Sept 25 5,461

Percent Change from Previous Year

	Nov 25	Nov 18	Nov 11
New England	+11.9	+13.1	+14.4
Mid-Atlantic	+13.1	+14.1	+15.1
Central Industrial	+19.9	+20.9	+30.7
West Central	+14.8	+16.0	+18.7
Southeast	+22.5	+22.5	+24.0
South Central	+23.8	+22.5	+22.1
Rocky Mountain	+13.9	+17.1	+14.6
Pacific Coast	+15.3	+22.3	+14.6
Total United States	+17.5	+19.2	+21.0

MEETINGS

Interstate Power Club of New York
Hotel Martinique, New York, December 11.

American Institute of Electrical Engineers
High Frequency Measurements Conference, sponsored with the Institute of Radio Engineers and the National Bureau of Standards, Statler Hotel, Washington, D. C., January 10-12; Winter General Meeting, Statler Hotel, New York, January 22-26.

Pennsylvania Electric Association
Winter Meeting, Transmission and Distribution Committee, William Penn Hotel, Pittsburgh, February 1-2.

★**Missouri Valley Electric Association**
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Missouri, February 8-9.

★**Adequate Wiring Bureau**
Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, February 15-16.

★**North Central Electrical Association**
Electrical Industries Convention, Nicollet Hotel, Minneapolis, February 25-28.

★ Addition this week.

WASHINGTON COMMENT

RONALD D. ROSS

"In many respects, the economic factor makes the civilian (atomic) power problem a tougher one than the atom bomb problem."

This is the pessimistic observation of perhaps the best authority on the subject of atomic power plants, Dr Lawrence R. Hafstad, boss of the Atomic Energy Commission's reactor development division. He recently had some plain words to say on the subject of practical atomic power. It's a straight-from-the-shoulder statement filled with reassurance for the electric utility industry which is plunging ahead with the addition of billions of dollars worth of advanced but basically conventional electric generating capacity.

Atomic Power Depends on Costs

Along with other practical-minded men in both the electric utility industry and the nuclear physics field, Dr Hafstad has not been one to be excited by the immediate or even foreseeable prospects for cheap atomic power. He doesn't cloak his analysis of atomic power prospects in difficult nuclear abstractions. Rather it's a matter of dollars and cents.

That's where atomic power production is different from the atomic bomb. The bomb was a $2-billion "crash" program designed to win a war. Unlike bombs, a practical atomic energy power plant will have to compete cost-wise with the mature and competitive power industry's best achievements over several decades of development. Here is the economic challenge which makes atom power a tougher problem than a-bombs.

Let's look at Dr Hafstad's cost estimates. But first, he points out, there are no firm figures. AEC does not have them; if it did, they could not be released; and, if they did exist, Dr Hafstad adds, "I wouldn't believe them anyway." Intelligent guesses, however, are not ruled out, and he's ready to make some.

A-Plant Costs More; Fuel No Cheaper

There are two basic elements of cost in power production—plant and upkeep. Based on estimates for the ship propulsion reactor project, an atomic plant might cost about $1,400 per kw installed capacity, against some $133 per kw for a conventional plant. The comparison is weighted, of course, by such things as naval requirements for a ship reactor, but there is a big gap to close between the two figures before atomic plant and equipment costs will be comparable to conventional ones. And to reduce the costs of an atomic plant, Dr Hafstad urges "design and construction of reactors on a competitive bid, fixed price basis, or by otherwise utilizing a profit making incentive."

The other major cost is fuel, where the atomic plant is popularly considered to excel. Dr Hafstad is less enthusiastic than some observers. Taking the generally written figure of $20 per gram for nuclear fuel, he calculates a rough cost of 1 mill per kwhr. Even this $20 figure, however, may be low and will increase "as the supply of high-grade uranium ore runs out."

The AEC's reactor chief concludes "that for nuclear power the cost of fuel will be about the same as for conventional plants, while the cost of the installation (and probably its operation) will be considerably higher."

Meanwhile, there will be electric power generated by atomic plants but only as a by-product to the production of plutonium or possibly other products. Some of this may even be done by private industry under such proposals as the privately financed atomic plant suggested by Monsanto's Charles Thomas. Basically, of course, this will not be a new age of atomic power. "Only if and when we can produce fissionable material which when used for civilian power will pay for its own production costs can we truly say that the civilian atomic power problem has been solved," Dr Hafstad declares.

Atomic power, he finds, may be compared to private flying. Most of us consider private planes an "unjustifiable luxury." And today's atomic power, too, is a "luxury civilians can't afford."

TECHNICAL NOTES

ARCHER E. KNOWLTON

Milled peat, under favorable conditions, can be produced for 19.8 pence per million Btu and machine-won sod-peat for 34.5 pence where coal costs 25.6 and oil fuel 56.

Sectionalization of the auxiliary bus for the sake of partial output can evidently be omitted in a unit plant for the sake of saving one or more breakers.

Three-phase power factor and capicitance of a three-conductor cable with metallic sheath can be found by proper use of the guard circuit of a Schering bridge employing only single-phase voltage.

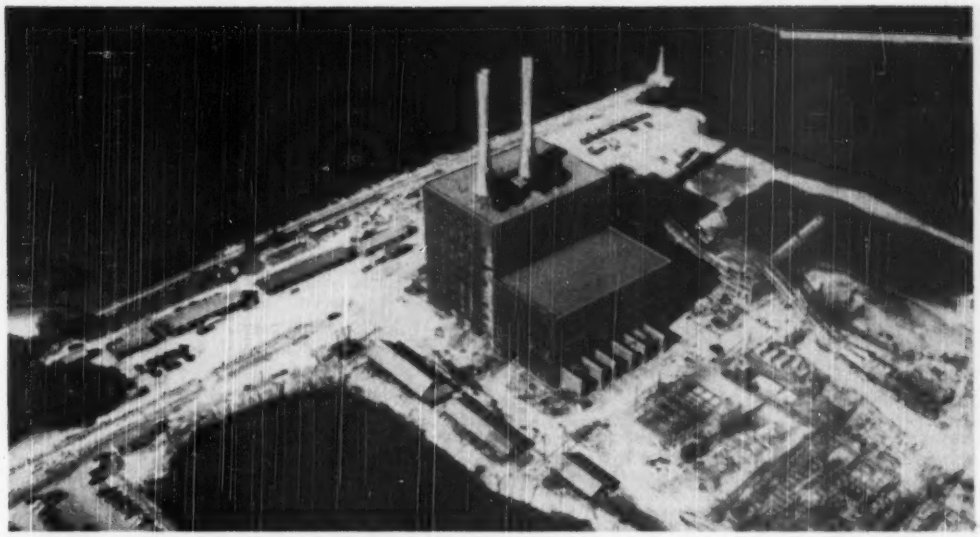
Speed can be measured to 0.003% by automatic counting of high frequency pulses for an accurately measured interval of time.

Microbial attack on synthetic rubber is much less aggressive than on natural rubber.

Distribution in mines is practically all at 2,300 or 4,160-v primary with a few already using 6,900 v.

Inaccuracy in speed measurement can completely mask the small gains in efficiency of apparatus from improvements in design, once the art has reached the plateau of "diminishing returns."

Self-supporting potheads have been devised for hanging 600-v mine cables in vertical bore holes.



DUNKIRK PLANT on lake-front fill helps form yacht basin for the city. Cofferdam was borrowed from future ash-disposal area

Dunkirk Station Departures Based On Prototype Experience

First reheat on system. Turbines reverse flow, double-flow. No steam-operated auxiliaries. Low makeup warrants small evaporative condenser. Automatic vibration if coal clogs. Mineral-insulated control cables and selective tripping

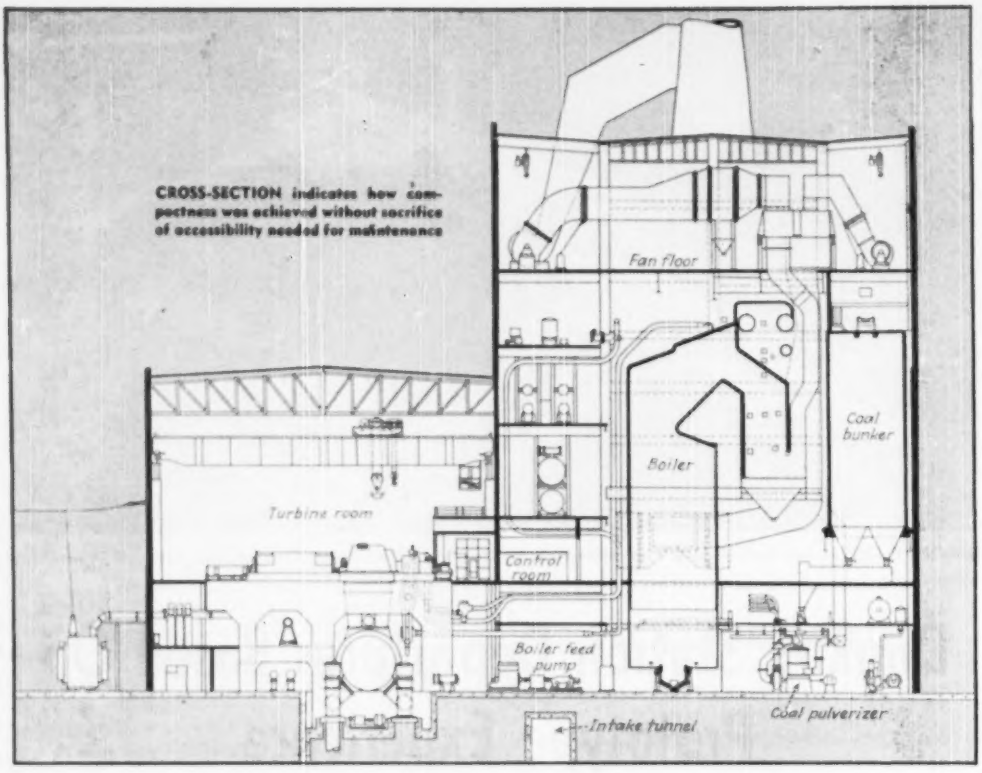
J. N. EWART, Chief Mechanical Engineer, and J. M. GEIGER, Electrical Engineer
Niagara Mohawk Power Corporation

Dunkirk Station is designed for an ultimate rated capacity of 320,000 kw embracing four units of 80,000/100,000 kw. The plant is designed for 9,600 Btu per kwhr, about 7% better than the 10,300 being achieved with Oswego No. 3 unit (1,250 psi/950 F). Most of the gain is attributable to adoption of steam reheat and the rest to higher temperature and pressure.

Reheat cycle was chosen for the first time on the Niagara Mohawk system because it offered at least 5% gain in efficiency independently of over-all gain from the higher (1,000 F) temperature than had been previously used (950 F) and the higher pressure (1,450 vs 1,250 psi) on the system. Another point of justification was the relatively high cost of fuel and the much better load factor than prevailed when predecessor stations on the system were built.

Tandem arrangement of the unit involves the first installation of a reverse-flow, double-flow machine. High temperature (1,000 F) steam at 1,450 psi enters the turbine near the middle and flows through the buckets toward the outboard bearing. It is then returned at 422 psia and 700 F (maximum capability conditions) to the boiler for reheat to 1,000 F and thence to the second high pressure section for flow in the opposite axial direction. The exhaust (at 318 psia and 405 F) also divides at the center of the low pressure section for flow in opposite directions. The point in both instances of reverse flow is equalized thrusts and minimized temperature differentials or gradients.

Resuperheat System . . . Reheat is accomplished in loops between the primary and secondary sections of the initial superheater and the flow is counter to that of the combustion gases. Reheat temperature is controlled by the tilt of the four burners at each of the four corners; initial superheat by steam desuperheater in addition to burner tilt. A stop valve at the boiler is used in addition to the turbine stop valves in high pressure superheat line. Experience has not



substantiated reliance on a single stop valve. For the sake of flow capacity two safety valves are installed in parallel in the reheat return to the turbine.

Close-spaced plain water-cooling tubes constitute the boiler furnace walls. Dry bottom furnace design was chosen as a logical accompaniment to tilting burner control.

Provision has been made to burn only pulverized coal, oil being used solely for burner light-off. Thermocouples on the oil burners are connected through alarm relays to lights on the control panel to indicate condition of the flame. Television is used for viewing the boiler gage level in the control room.

Soot blowing is done by air and is automatically sequenced as at Oswego. Convection sections are, however, provided with long retractible blowers instead of the rotary type at Oswego to facilitate maintenance without shutdown.

Regenerative Heaters and Evaporators . . . Three low pressure heaters in a single shell are located in the throat of the condenser largely to save space, shorten extraction piping runs, and reduce the amount of stored steam. The latter objective is beneficial toward avoiding the risk of overspeed in case of loss of load. All seven of the bleed heaters are closed except the fifth, the deaerator. Double-stack high pressure heaters (sixth and seventh extraction) were chosen to permit operation of either section alone in order to maintain temperature in case of heater trouble. The banks are normally operated in parallel.

As little as possible of the generated steam is to be used for anything but direct use in the turbines. For normal operation none will be diverted to jet or soot-blowing or any other auxiliary use because condensate cannot be recovered from such operations. Leaks will be prevented or corrected. Advantage is taken of the resulting low value of makeup (normally less than 5,000 lb/hr) to install an evaporative condenser of merely corresponding capacity. For abnormal conditions requiring possibly three or four times this amount, provision has been made for condensing the vapor in the fourth extraction heater or in the main condenser itself.

A storage tank is mounted immediately below the deaerator to afford a cooled supply for boiler feed suction in case of sudden decrease in unit load and a subsequent demand for feedwater by the boiler to maintain level.

Air Preheaters . . . Instead of the vertical tubular air preheaters as used at Oswego, the Dunkirk heaters are of regenerative design. The lower gas temperature (290 F vs 320 F at Oswego) incurs greater risk of surface fouling when dew-point temperatures are reached. It was felt this tendency could better be met and controlled in connection with the regenerative type. Doors have been provided so that top sections can be removed for cleaning without taking the boiler out of service. There are two preheaters per boiler and it is expected the operation will be adequate with one of the two

out of service for short intervals if that is necessary.

There are two forced-draft and two induced-draft fans for each 670,000-lb/hr boiler.

Condenser and Vacuum . . . Condensers are permanently split. There are no valves in the circulating water lines and therefore to clean one side of the condenser it suffices to stop the pump supplying that side and drain the shell. Vacuum objective is less than 1-in. in winter, 1.53 in. in summer. With half-condenser operation 3.6 in. can be obtained.

Dry-vacuum pump is motor-operated. At Oswego the vacuum is obtained by steam-jet air ejectors. But Dunkirk is a reheat installation and it is desirable to get steam into the reheat coils as soon as possible after firing. As soon as the pressure has reached 50-100 psi the turbine should be started so that there will be steam passing through the reheat tubes. This is difficult to achieve with a steam-jet air ejector. The motor-driven vacuum pump avoids the need for a hogging jet to lower the condenser pressure promptly from atmospheric to the starting value of vacuum. The jet is retained at Dunkirk only for back-up purposes since the dry-vacuum pump supplants its functions.

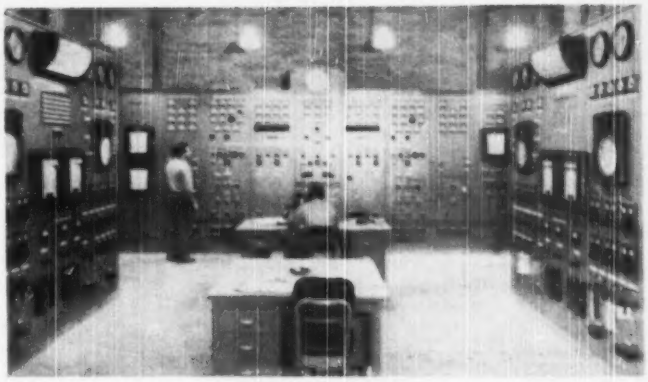
Condenser tubes are of Admiralty metal.

Tunnels are arranged for recirculation and complete reversal of condensing water flow in case of an ice jam at the normal lake intake.

Screen House . . . The screen house is placed in physical connection with the main plant building. Differential head actuates the screens automatically when trash begins to impede the flow of condensing water. All screen wash pumps are located adjacent to the screens. Plant office area is directly above the screen floor.

Initially all coal will arrive by rail; but the plant and coal handling facilities have been arranged for lake delivery of coal after adequate channel depth has been accomplished.

Coal and Ash Facilities . . . Automatic means have been provided to free the coal if it clogs in either a bunker hopper or in a feeder chute. The action at the bunker is as follows: if one of the coal valves is open and the scale starts to fill but the time



CONTROL ROOM view of, and access to, the turbine room is afforded by passageways either side of center panel. Electrical controls are under the clock (No. 1 to the left, No. 2 to the right); mechanical controls are on the side panels. Television replica of boiler-drum water level is on the boiler room wall behind the camera. Mirrors at the same location give a view of flame conditions

normally required for filling is exceeded, a timer contact will cut in the vibrator to restore flow of coal. An alarm will sound in the control room if it does not flow. At the feeder chute a contact on the feeder roll actuates a counter to measure the amount of coal delivered to the pulverizer mill for each 400-lb dump of the scale. If the scale gate fails to close it will indicate piling up of the coal. This starts the vibrator for only a three-second run so as to avoid further compacting of the coal. After three seconds an alarm sounds to indicate that the chute is still clogged.

Essence of the composite scheme is the focus upon the amount of coal being delivered in accordance with the output at the moment rather than upon predetermined timing.

Flyash is removed mechanically. Ashes from the hoppers below the furnaces are discharged into crushers that break up lumps when the hoppers are flushed out. The ash removal system is on sequential push button control.

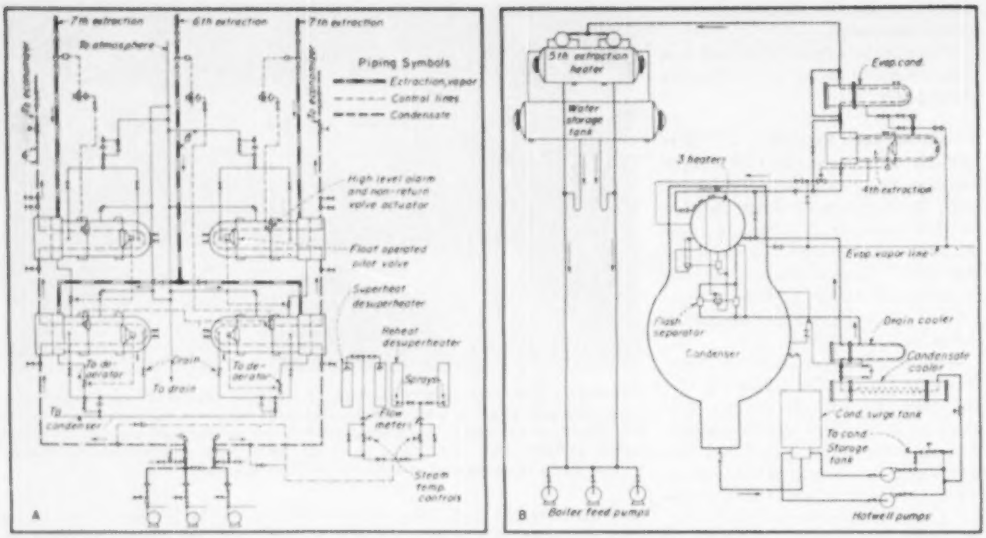
Adjustable Speed Couplings . . . At Oswego an hydraulic coupling was used on the boiler feed pump to afford means of adjustment to conform to load requirements. Subsequently a scoop device was added to obtain a booster effect during accelerating periods. Induced-draft fans at Oswego are equipped with electromagnetic couplings.

At Dunkirk the units are hydraulic on the 3,600-rpm boiler feed pumps because of the improved rate of response achieved with the modified design developed at Oswego. However, the rate of response still is hardly up to that of the electromagnetic couplings. Nevertheless offsetting advantages of the hydraulic couplings influencing the choice were: (1) The complete enclosure, (2) the lesser noise and (3) greater simplicity of controls. Bailey three-element control automatically regulates the speed of the boiler feed pump through the hydraulic coupling.

The improved hydraulic unit had not yet, however, become available in the 1,200-rpm frame size for application to the induced-draft fans and consequently the electromagnetic drives were chosen for them.

Control Room and Control Cables . . . Main control boards are located on the same level as the turbine-generators. The mechanical and electrical boards for two adjacent units are contained in one control room. No provision is made for the operators to see either turbines or boilers from their normal functioning positions at the boards but in a few steps they can look directly into the turbine room or the boiler room. Three operators will be in the control room at all times and all will be trained so that any of them can take full mechanical and electrical responsibility.

Control cables converge at the control room in fully enclosed asbestos-board troughs chosen primarily with fire protection in mind. The bulk are



EVAPORATOR VAPOR flows alternatively (by valve manipulation) either to the evaporative condenser or the fourth-stage heater, or the condenser, to meet capacity requirements. (A) High pressure heaters and (B) low-pressure heaters

multiple-conductor with polyethylene insulation and polyvinyl sheaths.

For the first time safety mineral-insulated copper-clad cable has been used for control circuits. In this instance the application was confined to runs from some 50 primary temperature detectors for air preheaters, superheaters, economizers, turbine oil, circulating water, feed water circuit, pulverizer mills, etc. This cable was considered quite versatile in that it can be used for both hot and cold locations and in all applications without conduit or protection against wetness.

The control room was purposely designed to be as compact as possible and the room is relatively small. There is a separate mechanical board for each unit and a combined electrical board for the two units of each pair.

Electrical Pattern . . . Simplicity was the primary aim in fixing the one-line pattern for the station. The generators feed directly to 3-phase forced-oil forced-air transformers of 110 Mva rating. Both cores and coils are subjected to forced-oil with no reliance on thermosiphon cooling except in case of loss of power supply to the cooling pump and fans. In that event a flow selector-damper opens to establish thermosiphon circulation for short period operation.

There is a main bus and a transfer bus; the only function of the transfer bus is for switching of the outgoing 115-kv lines for glaze melting. There is a tie-breaker between the unit sections. A 34.5-kv substation serves the adjoining area and its two 9,375-kva transformers having step voltage regulators are connected to the 115-kv bus only through disconnect switches.

All buses of the pedestal-type outdoor switchyard are thin-wall copper tube similar to what was used at Oswego.

Generators and Leads . . . The 13.8-kv generator leads are isolated-phase with a copper tube conductor enclosed in an aluminum housing as far as the main power transformers and along the taps to the disconnecting switches ahead of the station service transformers. From the latter to the service transformers the leads have an oil-base insulation (Gencorone) and are run in Everdur conduit.

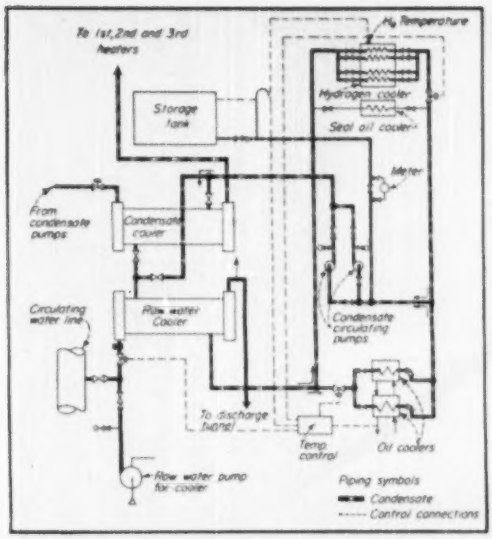
A separate water system is used for cooling the turbine-generator lubricating oil and the hydrogen which takes the generator heat losses. Previous installations on the system had the main condensate running through the coolers but an oil leak let oil get into the deaerator. Heat exchangers are preferred for this cooling function.

Auxiliaries . . . Previous practice on the system has been to put 2,400-v auxiliaries for each unit in two groups on two separate buses. But at Dunkirk all are in one group on one bus. This means one generator, one main transformer, one auxiliary transformer and one 2,400-v bus. If the voltage for the auxiliary group falls to 80% of normal an automatic transfer is made to the alternate supply in two seconds or less.

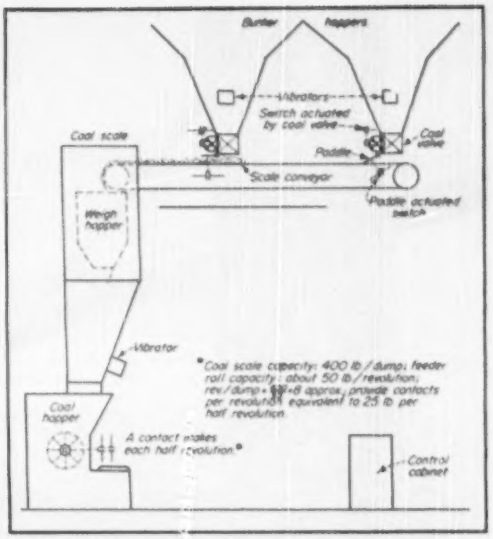
The auxiliary transformer connected to each generator has a 6,000-kva rating. Each large motor off the single auxiliary bus has separate circuit breaker protection. The 600-v auxiliaries are all fed from double-ended unit-type substations at appropriate locations, the transformers being 500 kva Class B, air cooled. All station transformers are three-phase.

Location of the 2,400-v auxiliary switchgear between the condensers and the building wall with the auxiliary transformers immediately outside permits greatly shortened bus runs and these were purchased as an element of the unit substation designs.

In line with recent developments by circuit breaker manufacturers a scheme of selective tripping was adapted and adopted for the 600-v breakers on the auxiliaries. The direct-acting tripping device was modified to afford time delay where needed, for



SIMPLIFIED ARRANGEMENTS for separate cooling of the turbine-generator hydrogen and lubricating oil



VIBRATORS are automatically started whenever the coal clogs either in a bunker hopper or in a feeder chute

short-circuit faults. This permits a tripping scheme comparable to that obtainable with induction-type relays.

Exciter System . . . Excitation voltage is 375 and the unit is direct-connected through gearing to 1,190 rpm speed for tooth diversity. The exciter can be used as a motor to accelerate the generator to over-speed for subsequent paralleling as a synchronous condenser after uncoupling from the turbine. The reserve exciter is used in this case for the main generator field and a 500-kw motor-driven generator supplies the direct-connected exciter.

Rated at 375 v the 500-kw generator is, however, capable of 480 v for 30 min starting period during which the generator is brought up to 3,700 rpm. Field is then applied and the speed allowed to drop to 3,600 rpm for paralleling. After this has been accomplished the starting generator is disconnected and the excitation of the main generator transferred to its own exciter bus.

Lighting, Air Conditioning . . . Lighting in the main turbine and boiler rooms is incandescent and intensity averages 15 ft-c. Comparatively few fluorescent lamps are used except in the troffers around the control room ceiling and along the 2,400-v switchgear. In the control room the indirect component to reduce sharp shadows is obtained from reflector floods around the perimeter established by the panel configuration. Office areas will have 50 ft-c.

Auxiliary switchgear areas and the control room are air-conditioned for cleanliness and comfort. Control room ceiling is soundproofed.

A paging system consists of microphones and speakers at appropriate points throughout the plant and affords instant communication not only with the control room but with all other points.

Manpower . . . Some of the major efforts made to render Dunkirk Station capable of operation with minimized staffing were these: (1) Centralization of controls, (2) paired units for joint control, (3) ash handling automatic sequential from push button start, and (4) more generous use of supervisory controls, alarms and annunciators.

As a consequence it appears that a 14% reduction has been achieved by comparison with Oswego, otherwise comparable in design. The predecessor plant averages about 50 employees per unit over-all and Dunkirk will average 43.

Building and Ventilation . . . Building walls are brick and glass except for the Robertson siding used for the temporary wall. Designers were skeptical of the durability (for the 30 to 50 year expected life of the plant) of alternatives to the orthodox brick construction.

Grating floors were used wherever a solid floor was not indicated by need for working and overhaul areas or by risk of drips and dropped material. These gratings also facilitate building ventilation in conjunction with the forced-draft fans which take in building air at the upper levels. Opened windows in the summer give the fans a partial outdoor supply.

At the fan floor level there is a monorail to handle equipment and a 7½-ton hoist is coordinated with it so that equipment can be handled from the service track on the ground floor through a well extending to the fan-floor level.

The plant site is entirely lake-front fill on a rock base, the built-up area constituting a jut which, in conjunction with a government breakwater, forms a yacht basin for the city of Dunkirk. The earth fill from an area behind the plant (later to be used for ash disposal) formed the cofferdams. Some local industrial waste was also used for fill. The well-point system was relied upon to keep the pumped-out lagoon dry while the foundations were laid on the rock bottom.

AERIAL CABLE, in place on high span on Mt. Pleasant side of Grace Memorial Bridge, Charleston, S. C. A three-bolt suspension clamp supports the 5/16-in. high strength Copperweld messenger on the steel bracket

Aerial Cable Installed on Bridge

Aerial cable, 13.8-kv, bracketed to bridge steelwork saves over other methods considered. Utility installation saved $3,000 over lowest contractor bid. Lightning tripouts and conductor failures have been completely eliminated

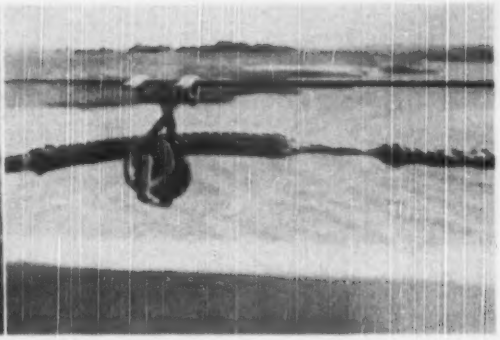
D. T. COLEMAN, Superintendent Retail Operations
South Carolina Electric & Gas Co, Charleston, S. C.

The South Carolina Electric and Gas Co has installed a unique aerial cable across the extensive Grace Memorial Bridge which spans the Cooper River to the east of Charleston, S. C. After a year's service there has not been a single case of trouble, whereas, an existing overhead 13.8-kv service line on wood cross arms with steel poles strapped to the same bridge usually has five or six tripouts due to lightning surges, and at least two to three conductor failures on the line due to lightning in a year's service.

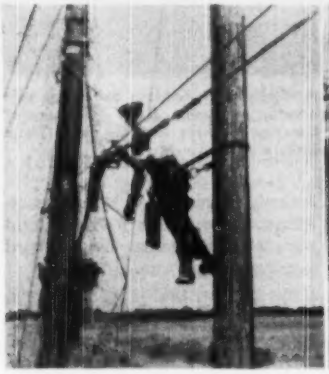
To the east of Charleston across the Cooper River Bridge are the towns of Mt. Pleasant, Sullivan's Island, Isle of Palms and McClellanville. These towns and the surrounding area were served by one 3-phase 13.8-kv circuit, which crossed the Cooper River as an overhead circuit on wood cross arms supported by steel poles which were strapped to the Grace Memorial Bridge.

The Grace Memorial Bridge was formerly a toll bridge, which was taken over by the State Highway De-

CABLE IN PLACE on Mt. Pleasant side of bridge—ready for first pull. Existing overhead 13.8-kv circuit at right



CABLE GRIP on tow line showing snatch block used to support cable. Conductors were pulled one at a time



CABLE GUIDE ready to pull first conductor. Cable is 1/C, 4/0 Awg, rubber insulated with Neoprene sheath

TWO-WAY RADIO was used by foreman at reel station to communicate with the truck pulling the cable

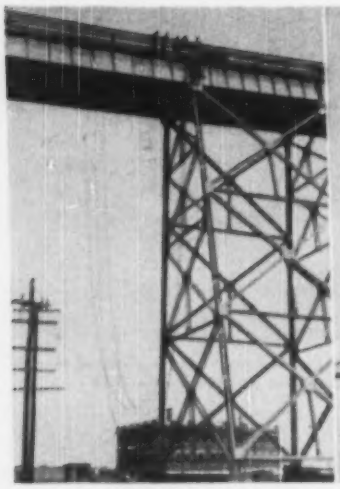
CABLE SPLICER making up splice in a single conductor cable. A three-conductor installation is not justified

Reduces Costs, Eliminates Outages

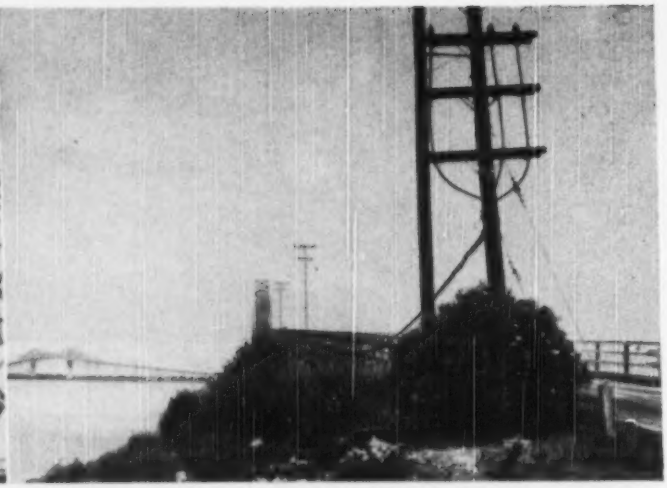
partment, and was immediately made a free bridge. Since that time a large number of new homes have been constructed in this area, resulting in a tremendous increase in the electric power requirements for the area. A study of the electrical requirements for the area indicated that it would be necessary to construct a second 13.8-kv line in order to adequately serve the needs of the area.

An engineering study was made of the feasibility and cost of constructing a second overhead line on the bridge, and this study indicated that all of the present poles on the bridge would have to be replaced, which would be prohibitive in cost, and would also require numerous interruptions in order to make these changes. A study was also made of the feasibility of laying a submarine cable across the river, but since it is necessary to dredge the channel in the river approximately every two to three years, it was felt that it would be too expensive to maintain a submarine cable under those conditions. A third study was made of the cost of installing aerial cable on the Grace Memorial Bridge, attaching it to the steel work with clamps and brackets. From this study it was apparent that this would be the most economical way to cross the Cooper River with the additional circuit, and in addition this type of circuit would give the least amount of trouble from storms, etc.

The cable selected for installation was a single conductor 4/0 Awg stranded alloy coated copper conductor, rubber insulated, shielded with conducting rubber tape and copper wires wound concentrically and imbedded in the tape, and with rubber sheath, 15,000 v for grounded neutral service. The single-conductor cable was used so that the conductors could be pulled in one at a time, and then the three conductors attached to the messenger wire with cable rings. The cable rings were used because the men could stand on the bridge, and attach the rings to the cable. At one time the use of a spinner to fasten the conductors to the messenger wire was contemplated but the location of the



VERTICAL RUN of 90 ft from Charleston side of bridge to terminal pole on street. Lineman in bosun's mate's chair is about to tie cable to girder



CABLE TERMINATION on Mt. Pleasant side of the river. Cable is carried up pole on cross arms and terminates in single-conductor potheads. A set of disconnect switches was also installed at this point between potheads and the line. There has been no case of trouble after approximately a year's service

cable with respect to the bridge made it impossible to use this machine. The use of three-conductor prefabricated cable was considered, but due to the difficulty in installing this type of cable, as well as the number of splices that would have been required, it was felt that the installation cost would have been too high to justify its use.

This job was assigned to one of our regular line construction crews. Upon completion of the job a comparison was made between the actual cost of installation and the bids received from the contractors. We found this cost to be approximately $3,000 less than the lowest bid received from the contractors.

Installation Relatively Simple . . . The first step was the installation of all the steel brackets and clamps which were to support the cable. On the straight part of the bridge these clamps are approximately 100 ft apart, and on the curved middle section they are only 50 ft apart. The terminal poles were installed at each end of the bridge and guyed. A 4/0-in. high strength Copperweld messenger was pulled in place, and attached to the steel brackets with the use of a three-bolt messenger suspension clamp. This messenger was pulled to a predetermined tension, using a dynamometer, and permanently clamped. Snatch blocks were attached to the messenger wire at intervals of approximately 33 ft. A reel of cable was set up on the Mt. Pleasant side of the river, and the first conductor was pulled in place. The conductor was then lifted out of the snatch blocks and fastened to the messenger with marlin ties.

The second reel of cable was set up, the conductor was pulled in place in the same manner, and the cable was tied to the messenger with marlin ties. The third reel of cable was set up, the conductor pulled in, and then all three conductors were fastened to the messenger wire with cable rings located approximately 18 in. apart. The marlin ties were then removed, and the cable allowed to rest in the cable rings. These cable rings are equipped with saddles, which are approximately one inch wide, for the cable to rest on. To prevent the cable from creeping, the cables were tied in on each side of all brackets with marlin. Each conductor was approximately 2,225 ft in length and since the total cable run was approximately 8,500 ft, it was necessary to set up three more reel stations on the bridge.

The conductors were pulled in one at a time, and were tied off in the same manner used in pulling in the first section of cable. When all of the conductors had been installed the splices were made up, and the joints were staggered so that the splices would be easier to make, as well as reduce the danger of breakdown at this point. Wherever a splice was made the shield wires were brought out and grounded to the messenger wire.

Vertical Run Saves Cable . . . On the Charleston side of the bridge, a vertical run of approximately 90 ft was made from the bridge down to a terminal pole on the street below. Brackets were installed on the steel girder at intervals of 12 ft, and the cable was attached to these brackets. The cable was then attached to a messenger wire, which ran from the steel girder to the wood pole, and then was carried up this pole on cross arms and terminated in single conductor potheads. A set of disconnect switches was also installed at this point between the single conductor potheads and the line for disconnect purposes.

On the Mt. Pleasant side of the river the cable was simply carried up the pole on cross arms, and terminated in single-conductor potheads. A set of disconnect switches was also installed at this point between the potheads and the line for disconnect purposes. As soon as the cable was installed it was put in service, and after approximately a year's operation we have not had a single case of trouble. In spite of a number of petty annoyances the job was completed without accident to any of the men.

Tree Wire Aids Conversion Program

Tree wire, 7620 v, saves extensive tree trimming. Few failures have been experienced to date

FRANK E. JOHNSON, JR.
Assistant Superintendent of Electrical Distribution
New Orleans Public Service, Inc, New Orleans, La.

New Orleans Public Service, Inc has installed over 133,000 ft of 8-kv tree wire in the New Orleans area. At the present time this includes wire of seven different types from eight manufacturers.

Failures to date have been six, confined to two makes—all No. 2 size. These failures occurred within 1 to 10 months after being energized. In each instance it is believed the failure was due to an electrical, rather than a mechanical cause such as abrasion. No further failures have occurred on one make since August 1948, and since May 1949, on the other.

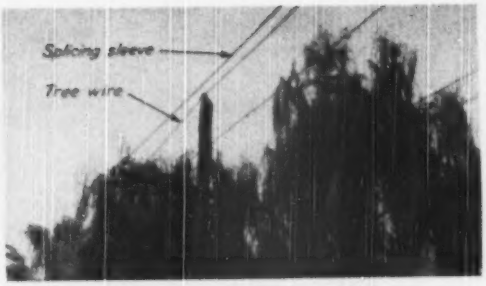
The price of this insulated wire has ranged from $167 to $569 per 1,000 ft for the No. 2 size, and from $393 to $625 for the No. 4/0. Installations to date, (starting in September 1947) have been mostly No. 2, and have been for laterals or branch distribution. Recently a start has been made with No. 4/0 tree wire, which is being applied in "backbones" of the feeders.

Rapid growth of the 2.3/4-kv distribution system in New Orleans, beyond the capacity of the station step-down transformers (from 13.2 kv to 4 kv) and the individual feeders, was the motivating factor behind the decision to convert a sufficient amount of this load, feeder-by-feeder, to hold down the demand of the remaining 4-kv load to a value within the station and feeder capacities. At the same time, where new areas have been developed as a result of new home building, the initial distribution has been from the 7.6/13.2-kv system.

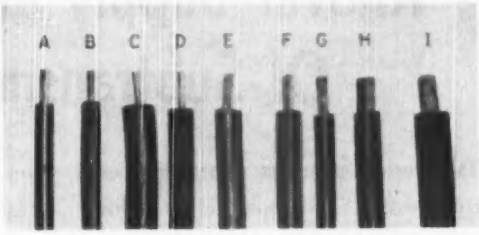
During the conversion, or extension of existing 7.6/13.2-kv facilities, the 8-kv tree wire has been installed as required, one or more spans at a time. The method of use is simple; The line crew pulls the wire in, applies an automatic splicing sleeve for connection to the bare wire beyond the trees, and ties in to insulator with S. D. No. 6 solid tie wires. The insulation is not removed at the insulator. In most of the installations up to the present time, the tree conditions have not been too severe. These will, of course, become more severe with time. There are, however, several cases of continuous heavy branch contacts which are being watched with interest. Conversion work now in progress will include some very difficult and long stretches of trees, through which both backbones and laterals must be installed.

The excellent cooperation of all the manufacturers concerned in submitting the various designs and types of tree wire is appreciated, as it is realized that in most instances the designs were untried at this voltage. The conversion program could not have been carried on in many areas without this tree wire, except by extensive and very costly tree trimming, for which approval is often difficult to secure. It is hoped that our experience with 8-kv tree wire will "prove out" one or more types of insulation which will be of use to the industry.

Adapted from paper presented at Engineering and Operation Section of Southeastern Electric Exchange.

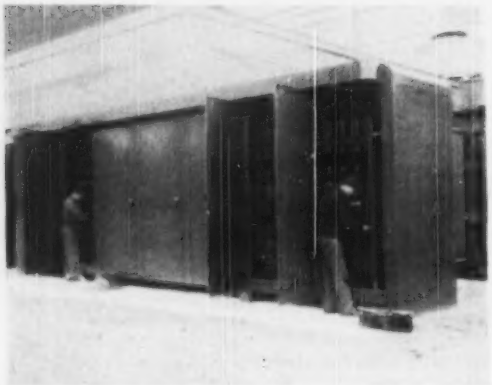


TREE WIRE (8-kv, single-phase) on pole pin terminates in an automatic splicing sleeve to connect with bare wire

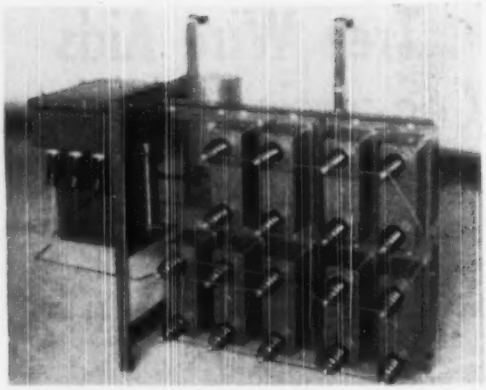


Tree Wire in Use by New Orleans Public Service, Inc

Identification	Size	Make-Up	Feet In Use March 1950
A	1/c-No. 2	Stranded H. D. Copper, 9/64 in. Polyethylene .015 in. Nylon. O. D.—0.62 in., Wt.—0.33 lb/ft	530
B	1/c-No. 2	Solid H. D. Copper, 10/64 in. Polyvinylchloride O. D.—0.60 in., Wt.—0.37 lb/ft	62,875
C	1/c-No. 2	Solid H. D. Copper, 16/64 in. Kerite, 7/64 in. Neoprene, O. D.—1.0 in., Wt.—0.65 lb/ft	4,500
D	1/c-No. 2	Solid H. D. Copper-10/64 in. Ozone Resisting I nsulation, .025 in. Fiber Tape Weatherproof Braid, O. D.—0.76 in., Wt.—0.42 lb/ft	2,500
E	1/c-No. 2	Stranded H. D. Copper, 10/64 in. Okorox, 5/64 in. Okoprene, O. D.—0.85 in., Wt.—0.49 lb/ft	11,750
F	1/c-No. 2	Stranded H. D. Copper, 10/64 in. Butyl-Polyethylene 5/64 in. Neoprene, O. D. —.83 in., Wt.—0.50 lb/ft	3,060
G	1/c-No. 2	Stranded M. H. D. Copper, 10/64 in. Polyvinylchloride O. D.—0.63 in., Wt.—0.38 lb/ft	5,000
H	1/c-No. 4/0	Stranded S. D. Copper, 10/64 in. Polyvinylchloride, O. D.—0.86 in., Wt.—0.94 lb/ft	26,000
I	1/c-No. 4/0	Stranded M. H. D. Copper, 10/64 in. Ozone Resisting Insulation, .025 in. Fiber Tape, Weatherproof Braid, O. D.—1.1 in., Wt.—1.09 lb/ft	2,000
J	1/c-No. 2	Stranded H. D. Copper, 12/64 in. Polyethylene, Nylon Braid, O. D.—0.72 in., Wt.—0.36 lb/ft	5,000
K	1/c-No. 2	Stranded S. D., 8/64 in. Polyethylene, 4/64 in. Habidure, O. D.—.783 in., Wt.—0.41 lb/ft	10,000
		Total All Sizes	133,215 ft



KILOVAR GENERATOR of type that might be used on metropolitan subtransmission system often making load ratio control unnecessary. The 5,100-kvar bank probably would be cable-connected to one 13.8-kv breaker on the station bus (Fig 2)



FURTHER SAVINGS RESULT if switched capacitors, like this 225-kvar, 4,160-v pole mounted equipment (nine 25-kvar units), can be placed closer to the actual load. Control cabinet (not shown) is normally mounted at base of pole

Kilovar Supply and Voltage Control Of Subtransmission Systems

The author suggests that high-power, long-distance hydro-transmission philosophy of no-kilovar transmission can be profitably applied to metropolitan power systems in some instances. More extensive use of load-area kilovar generation can relieve voltage troubles and thermal bottlenecks

C. A. WOODROW, Central Station Engineering Dept
General Electric Co, Schenectady, N. Y.

Reactive power, kilovars, cost so little to generate and so much to transmit that no one can afford to transmit them any great distance. This economic fact is never overlooked in modern planning of long distance, hydro transmission. The hydro-generator is designed primarily to generate kilowatts. Secondarily it may generate some kilovars—not for transmission but to supply part of the transmission kilovar losses. Kilovar generation is provided at the receiving end to supply all the kilovar load, and some of the transmission kilovar losses. Despite the high kilowatt loading of lines now possible with modern equipment, voltage variations at the receiving end are small. Generally, adequate voltage control can be obtained through control of receiving system kilovar generation; consequently, load-ratio voltage control equipment on step-down transformers becomes an unnecessary refinement.

Conditions are quite different in most bulk power metropolitan systems. Distances are not great and the usual turbogenerator is capable of generating at least half as many kilovars as kilowatts.

It will probably always be true that no steam generating plant can be economically designed to stand completely alone. The bulk power system tie facilities cost so little in terms of kilowatt capacity within the station that, no matter how efficient the station, the bulk power ties must provide at least reserve kilowatt capacity. This same reasoning, however, does not necessarily apply so far as kilovar generation is concerned. Provision for the flexible flow of kilovars necessitates the extensive use of load ratio control on bulk power transformers to obtain adequate voltage control. In addition, it increases the required kilovolt-ampere capability of the bulk power tie and transmission facilities.

It is the belief of the author that the hydro-transmission philosophy of no kilovar transmission can sometimes be applied in metropolitan bulk power systems. More planning should be directed towards generating practically all kilovar requirements within properly segregated load areas and using the bulk power facilities primarily for the interchange and transmission of kilowatts. Since the load area kilovar generation can readily reduce the required kilovar capability of turbogenerators, a question can eventually arise concerning the long-range

validity of present standard practice. A power factor rating of 0.85 could prove to be too low for "preferred standard" generators.

Each metropolitan bulk power system seems to have its own peculiar problems. Furthermore, new requirements, such as the absorption of new blocks of power generated some distance away, can materially change the over-all pattern. Nevertheless, in many cases fairly definite segregated load area plans have evolved. Some typical cases will herein be analyzed from the standpoint of kilovar supply and voltage control. Neglecting voltage control, extensive kilovar (variable) generation can often be justified by other subtransmission conditions within the segregated load area. In addition, kilovar generation sometimes leads to such voltage improvement that load ratio voltage control of subtransmission and bulk-power-tie transformers is unnecessary.

I. Load Ratio Control vs Variable Kilovar Generation For Subtransmission Voltage Control

If and when it is necessary to transfer kilovars from one section of a system to another, load ratio voltage control of transformers can be classified as complementary equipment. In this case, the load ratio control and the external kilovar generator are in no sense competitors. Fig 1 illustrates this case: a two generator station with local subtransmission at generator voltage and ties to a higher voltage bulk power system.

Rational system planning asks that normal voltage be maintained even though both generators are out of service. However, the reactance of the bulk power system, including the two bulk power transformers, may readily be as high as 15% (based on the kilovolt-ampere of local load) and the subtransmission supply voltage would then drop about 8%, unless load ratio control is included on the transformers.

Now, however, assume the station includes four generators, two of which will always be in service during heavy local load. It is readily conceivable that sufficient kilovar generation can be added out in the subtransmission area so that the kilovar generation plus any two of the four generators could supply all the local kilovar requirements. In this case, no kilovars need be drawn from the bulk power system, and the load ratio control may no longer be needed. In an important sense, therefore, load ratio control and kilovar generators have become direct competitors.

This competition between load ratio control and kilovar generation becomes more clear-cut as we move out into the subtransmission load area. Let us first identify certain fields of application where load ratio control has outstanding advantages over the switched capacitor, which is usually the lowest cost type of variable kilovar generator:

A. Where the total range of required voltage control is high. . . When transmitting block power hundreds of miles, voltage drop is tremendous unless kilovars are generated at the receiving end. This is not true in subtransmission. Voltage control of ±10% is readily attained with load ratio control. Yet, that is usually beyond the practical range with the switched capacitor. A 5,000-kvar capacitor, for example—working through a 10-mile, 34.5-kv overhead circuit—gives only a 3% increase in voltage.

B. Where the voltage drop occurs in circuits or apparatus with a high R/X ratio. . . Switched capacitors, working through the source reactance, cannot readily overcome the voltage drop caused by high resistance. Perhaps they can be justified in terms of loss saving but they cannot do much in terms of voltage control.

Where neither of these conditions exist, the switched capacitor should have a real chance. That chance is better where loss evaluation is high and a lot better where the power must pass through equipment or circuits which are limited in capacity by thermal or kilovolt-ampere considerations.

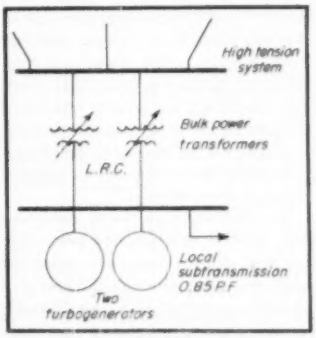


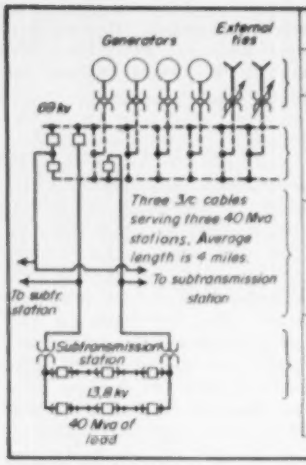
FIG 1—HYPOTHETICAL STATION combines generation from two units with local subtransmission at generator voltage and ties to higher voltage system

Much has been written about the advantages of capacitors for increasing the kilowatt loading of kilovolt-ampere-limited equipment. The qualitative story in this regard is fundamentally sound, but its quantitative evaluation must be approached with caution. If a 10% increase in load, served through kilovolt-ampere limited equipment, is made possible by adding load area capacitors, it is not necessarily true that the capacitors can be credited with a 10% saving in cost per kilovolt-ampere of load. Probably the best criterion of that saving is the alternative "incremental kilovolt-ampere cost" of increasing the kilovolt-ampere capability of the equipment so that it could handle the increased load. Both utilization conditions and apparatus cost characteristics can cause big variations in "incremental kilovolt-ampere cost." The example of three-conductor cable application illustrates this quite well:

1. Assume a 34.5-kv subtransmission cable system in the early stages of development, the cable not yet installed, but total load such that about 250-Mcm cable appears to be required. It would be possible to generate kilovars in the load area and reduce the required kilovolt-ampere capability of the cable. However, 250-Mcm cable is not an economical size. Cable economics are such that a smaller cable would cost considerably more per kilovolt-ampere of load carrying ability. In this case, the "incremental kilovolt-ampere cost" involved in using a little more copper (to permit kilovar transmission) is less than half the cost per kilovolt-ampere of 250-Mcm cable.

2. Assume the planner overbuilds his system, and, for reasons of long-range economy, uses larger cable than is initially required. In this case, then—and until the load increases—the "incremental kilovolt-ampere" cost is essentially zero. It costs practically nothing to carry the extra kilovolt-amperes added by the kilovar transmission.

3. Assume a system which has a lot of cable already installed—conductor size does not matter here—but which



	Description	Reserve	Incremental cost per kva of load
A	6 sources with load for 4	50 %	$7 x 1.50 = $10.50
B	Feeder breakers only	—	$\frac{4 \times 25{,}000}{120{,}000} = \$0.80$
C	Cable: $1.75 per kva of rated load per mile	50 %	4 x 1.75 x 1.50 = $10.50
D	Type OA/FA/FA Transformers (No L.R.C.) and 6 breakers (500 Mva)	Each transformer is large enough to handle the total load in an emergency	$ 6.00
			Total..... $27.80

FIG 2—COST ANALYSIS of a metropolitan 69-kv cable system

needs more cable load-carrying ability to all or most load areas. In this case, we have the ideal kilovolt-ampere limited condition. By generating kilovars in the load area to increase cable peak load power factor, we increase the kilowatt capability of existing cables. The "incremental kilovolt-ampere cost" is the cost per kilovolt-ampere of new cable, since the only alternative is the installation of additional cable.

II. Metropolitan 69-kv Cable Systems

A number of our largest metropolitan systems fall under this classification. They have high load densities and a lot of kilovolt-ampere-limited apparatus and circuits. This case may represent a most attractive field for the installation of switched capacitors in the load area. In some actual systems, the bulk power and subtransmission systems are inextricably mixed together and it is extremely difficult to analyze "segregated load areas." However, in some cases, a pattern roughly similar to that shown on Fig 2 has evolved. Analysis and discussion of this pattern will now be attempted.

A. The Generating Source. . . The cost of generating kilovars in the turbogenerator is extremely variable. Any system which uses the "preferred standard" 0.85 pf machines must provide whatever system kilovars generation is required to properly co-ordinate with the kilovar capability of the generators. Greater kilovar generation than is required for that co-ordination can lead to no generator savings whatsoever. It can, however, logically be claimed that the switched capacitor is a big help in generator standardization. Whatever the standard power factor—so long as it is not too low—the system requirements can be met by adding kilovar generation.

Assume, however, that the metropolitan system is too big to use "preferred standard" generators. With big custom-built generators, the incremental cost per kilovolt-ampere should be about the same as the average cost per kilovar. Here $7 per kilovolt-ampere is included for the incremental cost per kilovolt-ampere of generator and step-up transformer.

The system has four generators with integral transformers and two ties of similar capacity to other stations. Total load is taken to be the total capability of the four generators. Since any two of the six sources may conceivably be out of service, the remaining four must be capable of generating both the kilowatt and kilovar requirements of the system.

For simplicity and to be conservative, the tie transformers and their external systems here are taken to have the same incremental cost per kilovolt-ampere as the $7 per kilovolt-ampere of local generators and step-up transformers. However, since source capacity is 50% greater than the load, the incremental cost per kilovolt-ampere of load is $1.50 X $7 or $10.50.

B. The 69-kv Switchgear. . . In general the 69-kv bus and generator breakers can, without change in cost, handle any reasonable kilovolt-ampere variation brought about by the location of kilovar generation. However, since this particular subtransmission pattern demands four feeder breakers for each group of three cables, if we increase the kilowatt capability of the cable, we increase the kilowatt capability of each feeder breaker. In this case, therefore, the feeder breakers can be included as kilovolt-ampere-limited equipment.

C. The Subtransmission Cable. . . The pattern here is that recently adopted in Chicago; ie, three cables serving a total load of 120 Mva, each normally carrying 40 Mva but capable in emergency of handling 150% load (see Reference I). The total load is supplied by using the proper number of independent, three-cable patterns.

This loading is almost maximum for 69-kv, 3-conductor, lead-covered cable. If bigger conductors with higher kilovolt-ampere capability were substituted, the "incremental kilovolt-ampere" cost might readily be higher than the cost per kilovolt-ampere here included.

D. Subtransmission Stations. . . This firm power 40-Mva station is not too big to economically supply the underlying distribution—if the load density is fairly high. Higher kilovolt-ampere is prohibited by the 120-Mva limitations of the subtransmission pattern—unless we jump to 60 Mva which means higher 13-kv cable costs (see Reference II).

Admittedly, for the highest load densities and where station real estate is hard to obtain, the 40-Mva station is too small. However, for the purposes of this analysis, it is assumed that where bigger stations are required, two of these 40-Mva stations can be located on one piece of property without changing the basic subtransmission pattern. Kilovar generators may be added to the station 13.8-kv bus to increase the kilowatt loading, but the kilovolt-ampere loading is fixed at 40 Mva. Total station apparatus—less feeder switchgear—is kilovolt-ampere limited equipment.

Analysis of Investment Savings Possible By Installing 15,000 kva of Capacitors in 40-Mva Subtransmission Station (Fig 2)

	Without Capacitors	15 Mva Of Capacitors On 13.8-kv Bus
Source Incremental Costs, $ per kva (from Fig 2)	$27.80	$27.80
Kw Load	34,000	34,000
Kvar Load: Transformers	21,000	9,000
Kvar Load: 13.8-kv Feeders	21,000	24,000
Source Cost, $ per kw	$\frac{27.80}{.85} = \$32.70$	$\frac{34}{39} \times \frac{\$32.70}{} = \$28.50$
Switched Capacitors (@ $8 kvar): Cost $ per kw		$\frac{\$8 \times 15{,}000}{19{,}000} = \$3.10$
Total Cost per kw	*$32.70	*$31.60

* Overall investment saving with capacitors = $1.10/kw of load.

E. Kilovar Supply. . . If we assume that the load is at 0.85 of the 40,000-kva load at each station amounts to 34,000 kw and 21,000 kvar. The addition of 15,000 kvar of switched capacitors—say in three groups of 5,000 each—would allow an increase of 5,000 kw per station without exceeding 40,000 kva. The accompanying table illustrates the possible savings.

Still further savings may be gained if the switched capacitors can be placed closer to the actual load; ie, in the distribution system. The distribution system, however, is beyond the scope of this paper. The important point, so far as this analysis is concerned, is that the capacitors can sometimes more than pay for themselves in generation and subtransmission savings.

F. Voltage Control. . . Whether or not capacitors are used, it hardly seems necessary to use load ratio control at this subtransmission station. With no capacitors and generating station voltage held constant at 69 kv, the subtransmission station 13.8-kv voltage should drop no more than 4% under normal conditions—though under the emergency loss of one transformer, that drop would be doubled.

With load ratio control as is shown on the generating station tie circuits, it should not be too difficult to compensate for that 4% voltage fluctuation with load by manual control of the generating station 69-kv bus voltage.

As a rule, the 13.8-kv system serves distribution substations and those substations will include voltage control of their 4-kv bus or 4-kv feeders. In such cases, why also add the cost and complexity of load ratio control at the subtransmission station?

If, on the other hand, the 13.8-kv system serves a secondary distribution network, there is no underlying voltage control and the picture is somewhat different. Conceivably a 69 to 13.8-kv transformer and one or more 13.8-kv cables may be out of service at the same time. It may in this case be sensible to improve the voltage level. If so, the use of switched capacitors on the 13.8-kv subtransmission station bus should be sufficient. The 13.8-kv feeders of the table have a maximum wattless load of 24,000 kvar. So long as the minimum wattless load is not less than 9,000 kvar, the 15,000 kvar of switched capacitors can absorb all the variation. In that case, since the voltage drop caused by circuit resistance is negligible, the 13.8-kv subtransmission bus voltage is held at essentially flat voltage under normal conditions—and the emergency loss of a transformer causes only a 2% reduction in voltage.

One further question can now be raised. With the switched capacitors, is the load ratio control on the external tie transformers really necessary? Probably not—if the external bulk power system can be operated at constant voltage. Two of the four generators can carry the net subtransmission kilovar requirement if capable of 0.85 power factor operation at maximum kilowatt output.

G. Influence of Load Density . . . With lighter load density, the rational size of the 69/13-kv subtransmission station may be appreciably less than 40 Mva (see Reference II). In this case, the foregoing cost analysis unfairly favors the switched capacitors in several ways.

1. The three-cable subtransmission pattern may be called upon to handle a much smaller total load, say 75 to 90 Mva. In this case, much smaller cables can readily handle the load. A minor increase in conductor size can provide for kilovar transmission and the incremental cable cost of supplying the kilovars from the generating station, rather than the subtransmission station, is greatly reduced.

2. Since the total subtransmission station load will usually be limited by the economics of the underlying 13.8-kv system, rather than the subtransmission system, it is unreasonable to assume that the addition of kilovar generation will increase the practical kilowatt capability of the subtransmission station.

These factors indicate that the overall investment savings with capacitors may, at first glance, appear appreciably less than the table analysis—

(*Continued on page* 172)

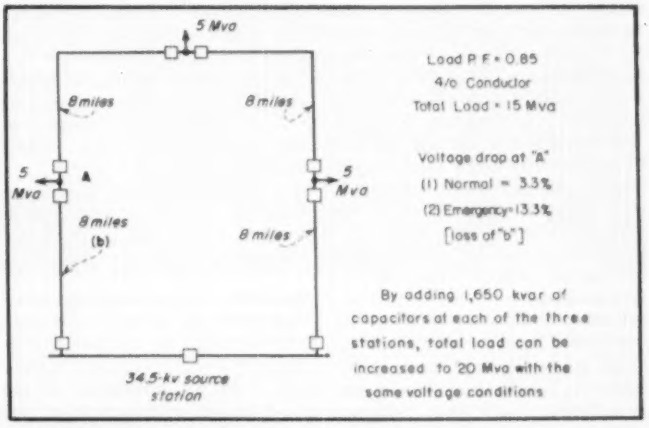


FIG 3—REPRESENTATIVE 34.5-kv loop subtransmission system

REMOTE INDICATING and control equipment installed by California Electric Power Co to operate this system of reservoirs in the High Sierra will pay for itself in less than five years. Work performed by six caretakers stationed at the reservoirs and intakes is now handled remotely or by two hydrographers with all-weather transportation equipment

Remote Control Pays Off For Reservoir System

Remote indication of reservoir level and discharge, plus accurate control of discharge contribute to better operation, save manpower; repays its cost in under five years

H. A. EVANS, Assistant Superintendent of Hydro Generation
California Electric Power Co, Riverside, Calif.

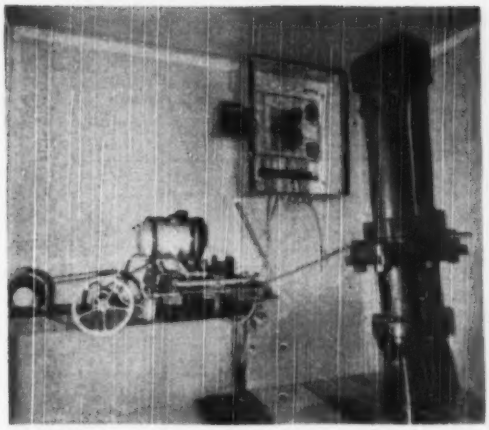
Conversion to remote observation and control of reservoir operation, and automatic recording of weather data has reduced operating costs on California Electric's Bishop Creek hydro system enough to pay for itself in less than five years. Remote indication and control of reservoir level and discharge rate, plus two trained hydrographers equipped with all-weather jeeps and snow vehicles now do the work of six caretakers formerly employed to measure and regulate water flow and record precipitation and temperature data.

California Electric operates five small hydro plants in series on Bishop Creek, about 270 miles north of Los Angeles. Telephone circuits existed from the dispatching center to the two reservoirs. Successful conversion to remote and automatic operation required solution of four main problems:

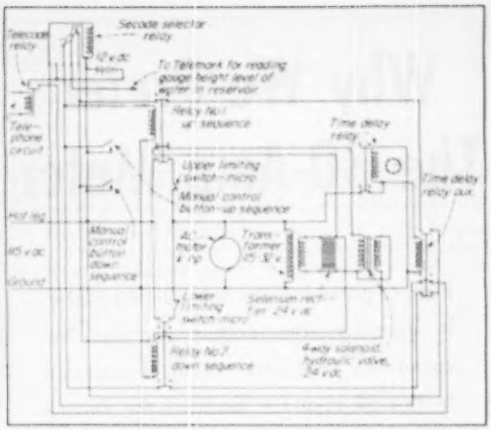
1. Remote regulation of water discharge from the reservoirs.
2. Remote measurement of amount of water discharged and reservoir level.
3. Recording of daily temperature and precipitation at each of four weather stations.
4. Emergency access to operating locations and monthly access to weather stations during the winter season.

Regulation . . . . Design calculations showed that the discharge valve at the reservoir could be operated hydraulically by a 1/20-hp motor, compared with 5 hp for mechanical gearing. The hydraulic equipment shown was assembled by the author from standard airplane components. It operates at 400 psi, but all components are good up to 2,000 psi, giving a wide design factor of safety. Operation of the hydraulic piston to open or close the reservoir outlet is controlled by a four-way magnetic valve. This valve is in turn controlled by a code selector relay operated remotely by a coded signal over a standard pair of telephone wires from the control point (see diagram). Amount the valve will be opened or closed each time a signal is received is adjusted by setting a time delay relay. The adjustment has been set to give a 36-sec cycle, which effects an average change of 3 cfs for each impulse.

Measurement . . . . A Stevens Telemark used in conjunction with a standard measuring weir fulfills the requirements for measuring flow from the reservoirs. It is positioned by a float in a stilling well in the measuring circuit and connected to the telephone circuit through a code selector relay. When the dispatcher wants to know the amount of water being discharged he presses a button which sends out the proper code for the sta-



REMOTE OPERATION of reservoir discharge valve in measured increments was tough problem. Motor and hydraulic system, at left, supply operating power through a four-way valve electrically controlled by a code selecting relay which takes raise or lower signal from ring of a regular telephone line


Secode selector relay
To Telemark for reading gauge height level of water in reservoir
Time delay relay
Time delay relay aux.
Upper limiting switch—micro
Manual control for Mon-up sequence
Manual control button down sequence
Trans-former
Lower limiting switch micro
Selenium rectifier 24 v dc
Relay solenoid hydraulic valve, 24 v dc

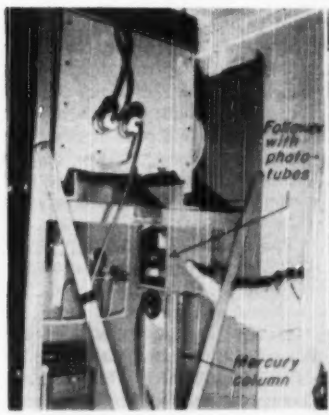
UP OR DOWN SEQUENCE is selected by appropriate code ring from the dispatcher. Hydraulic system operates only one way; direction of valve operation is determined by solenoid-controlled four-way valve. Time delay relay is adjusted for 36-second cycle—a change in flow of about 3 cfs

tion in question. The code selector relay energizes the Telemark and lifts the telephone receiver. Three microswitches contact a series of cams positioned by the float and send over the telephone transmitter decade, unit and tenth signals giving the water level and therefore height over the weir, which the dispatcher converts by a chart to amount of water flowing.

Since the cost of stilling wells in the reservoirs, which are 131 and 65 ft deep, would have been prohibitive, a mercury manometer was balanced against the pressure in a copper tube running to the bottom of the reservoir. Transmitting equipment is the same as for the direct measuring equipment, and is controlled by the same type of a code selecting relay.

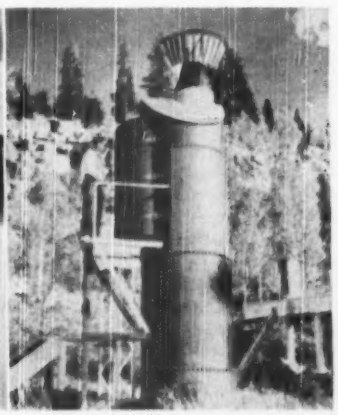
Recording . . . . All stations are furnished with clock-driven 30-day precipitation and temperature recorders. These were installed in sections of 48-in. diam pipe salvaged from old flow lines and erected on concrete bases.

Total cost of the conversion, including all equipment and installation was approximately $44,900. Savings in wages alone, even allowing for the higher pay scale of the two hydrographers, total $11,390 annually—representing a return of 25.4% on the investment.



LAKE LEVEL is given by system using a follower and two photo tubes to measure height of a mercury manometer balanced against the pressure in a copper tube coming from lake bottom. Follower positions three rotating discs arranged with three microswitches to give decade, unit and tenth readings as series of audible buzzes over the telephone

CODE SELECTOR RELAY (center left) responds to the proper coded ring for its station, energizes the receiver lifting mechanism and sets up the proper circuit for valve operation or level measurement desired. Audible signal indicating lake level or weir level is returned to the dispatcher by the buzzer over the telephone transmitter



PRECIPITATION and temperature recording instruments are housed in salvaged sections of 48-in. flow line set on concrete base. Records are changed every 30 days by hydrographer, who is only man normally visiting the reservoir equipment in the winter months. Safety of the hydrographer is checked by means of a mobile transmitter and receiver

Why We Prefer The 30-Amp Meter

First to purchase the new 30-amp meter in quantity, the author explains his conviction that this rating is superior to the 50 amp for loads of the future

E. L. KELLER, Superintendent, Meter Division
Duquesne Light Co

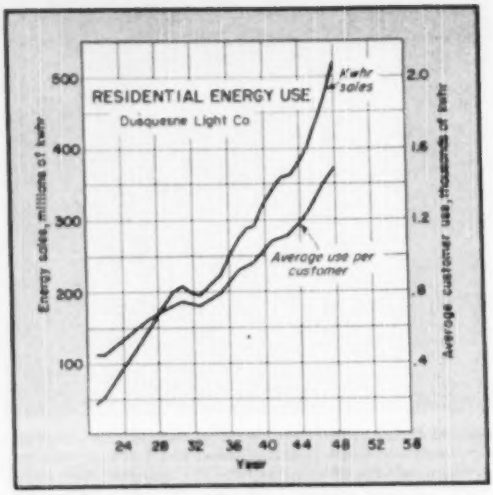


FIG 1—RESIDENTIAL USE on Duquesne Light system reflects reasons for move to higher meter ratings

"What size kilowatthour meter should a utility buy to properly measure the future energy use of its customers?" This watthour meter question deserves careful attention today not only because a large capital investment is involved, but because watthour meters have certain characteristics which must be considered before the problem can be answered.

Up to the present, watthour meters have become obsolete not because they have worn out, but because:

1. Important meter improvements have been introduced.
2. The older meters became inadequate to carry increasing load.

However, on the 30 amp we now have a device that incorporates almost every desirable characteristic: 400% overload rating, an excellent registration curve, good temperature compensation, lightning protection, excellent bearings, and high surge resistant insulation. These are only a few of the items which lead us to believe that these meters will be good for many years of service.

To take advantage of this long life it is necessary that metermen purchase and install meters that have the capacity to handle future load growth.

Recent History of Meter Size . . . Fifteen years ago, the outdoor socket meter was introduced as a remedy for current diversion and as a source of greater operating economy. The transition from the indoor type meter to the new outdoor socket meter gained momentum slowly, but is now generally accepted. The outdoor meter and its socket were designed to handle load prevailing at that time. The old indoor meters were primarily of a five-amp rating. Without giving much thought to the future, it was natural that the new socket meters were ordered with the same rating. Accordingly, the Duquesne Light Co purchased something like 35,000 5-amp type-S meters. By 1938, however, it was evident that the 5-amp meter was no longer adequate. So it was that this company, along with utilities in general, began buying 15-amp meters. The 5-amp meter became generally inadequate, except for transformer-type metering.

Residential and Commercial Load Growth . . . Growth of residential and commercial energy use on the Duquesne Light Co system has continued at a remarkable rate. Fig 1 and 2 show, for example, that during the 15 years from 1933 to 1948 inclusive, average residential and commercial use per customer more than doubled. Residential use went to 205% and commercial use to 203% of 1933 values. These load increases do not diverge too widely from the national pattern.

In an article entitled "Load Will Triple in Fifteen Years," **Electrical World** predicted in its May 22, 1950, issue, that residential and farm use of energy per customer will grow to 265% and the commercial use to 206% of the present value in the next 15 years. Our own planning and development department is not quite so optimistic. It feels that residential use will probably double within the next 15 years or so.

Energy to be measured, however, is not the only factor that will determine meter size. Customer's demand, his peak load, must also be considered along with his total consumption. Then the question arises: "Will the expected increase in average kilowatthour load result in a like increase in demand or peak loads"?

For several years Duquesne Light Co's planning department has studied the load factor pattern of over 700 residential and commercial customers. They conclude that unless there is a considerable unforeseen increase in the use of off-peak energy, residential and commercial load factor will not change materially from year to year. Therefore, it seems safe to assume that the kilowatt demand of these customers will increase roughly in proportion to their increased energy use.

What Size Meter Now? . . . In the light of all this, then, it is very doubt-

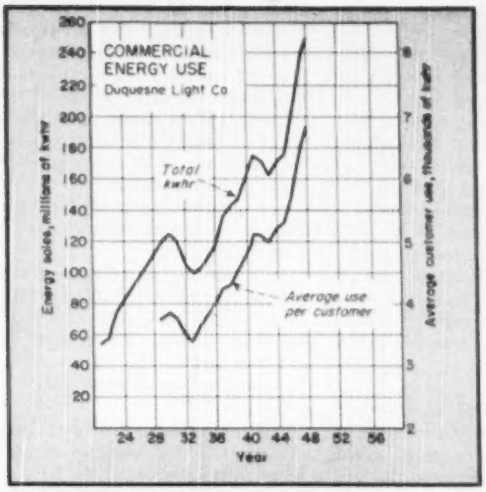


FIG 2—COMMERCIAL USE on the Pittsburgh system reached 203% of its 1933 value by 1948

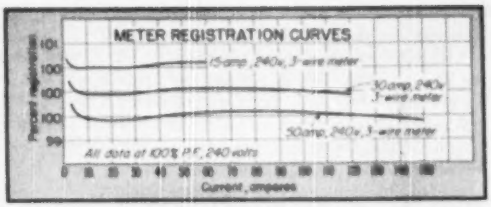


FIG 3—REGISTRATION CURVES of 15, 30 and 50-amp meters show 30-amp meter can handle loads to 120 amp; the 50-amp meter can handle loads to 150 or 200 amp

TABLE I—Registration Lost By Meter Loaded Below Starting Watts for Eight Hours

Meter Amp Rating	Starting Watts	Meter 8-hr Load	Monthly Loss	
			In Registration	In Revenue*
5	4	4—	1 kw	1.7¢
15	12	12—	2.9 kw	4.9¢
30	24	24—	5.8 kw	9.9¢
50	40	40—	9.7 kw	16.5¢

* Based on minimum rate of 1.7¢.

ful whether present 15-amp meters are adequate for such future loads. A larger meter seems definitely indicated, provided that there be no appreciable sacrifice of performance on present loads.

Until recently, the 50-amp meter was the next size meter available above the 15. This capacity rating has several disadvantages as will be pointed out later.

Within the last six months, a new 30-amp size has become available which seems to be the best answer to the requirements of present and future loads.

Why A 30-Amp Meter? . . . Fig 3 gives registration curves for a 15-, a 50- and a new 30-amp meter. These curves show that the 15-amp meter will register properly all loads up to 60 amp, the 30 loads up to 120 amp, and the 50 will measure loads up to 150 or 200 amp in the case of the later extended range meter.

The temperature rise of the jaws in an ordinary S-type meter socket are shown in Fig 4. Based on a 40 deg C allowable rise, it is apparent that about 100 amp is pretty close to the thermal limit as far as the current capacity of socket jaws is concerned. This limit can be raised a little by using heavier wire to the socket. Copper leads help to dissipate the heat generated in the socket jaws.

Therefore, unless more expensive heavy-duty socket troughs are used, even the extended range 50-amp meter is limited to about 120 amp. By comparing Fig 3 and 4, it is apparent that

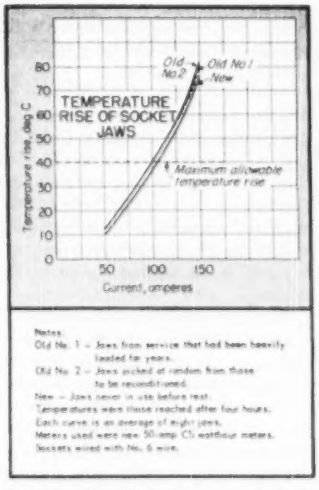

TEMPERATURE RISE OF SOCKET JAWS
Old No.2
Old No.1
New
Maximum allowable temperature rise
Temperature rise, deg C
Current, amperes
Notes:
Old No. 1 – Jaws from service that had been heavily loaded for years.
Old No. 2 – Jaws picked at random from those to be reconditioned.
New – Jaws never in use before test.
Temperatures were those reached after four hours.
Each curve is an average of eight jaws.
Meters used were new 50-amp C5 watthour meters.
Sockets wired with No. 6 wire.

FIG 4—THERMAL limitations hold S-type jaws to 100 amp with 40 C rise

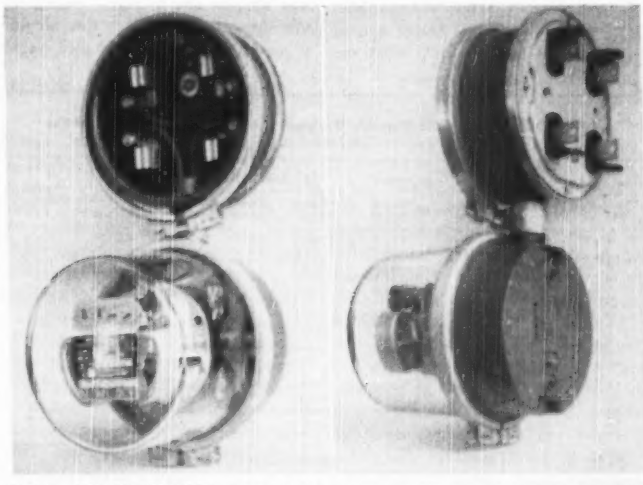


FIG 5—DOUBLE SOCKET of type being used to facilitate test installation of 15- and 30-amp meters on customer's service for comparison purposes

the 30-amp meter has a range equal to or greater than the thermal rating of our meter sockets. In other words, the 30-amp meter will do all that the 50-amp meter will do within the thermal rating of our present socket jaws.

The 30-amp meter has other basic advantages over the 50-amp meter. Many of the compensating schemes that have been developed for the electromagnet of the 15-amp meter cannot be applied directly to the 50-amp meter. Complications arise because the two meters don't have current coils with the same ampere-turn basis. The 30-amp meter, on the other hand, has the same number of ampere-turns as the 15. The only difference between the 30 and 15 amp is that the current coil has half the number of turns and twice the size of copper.

Moreover there is a worthwhile economic advantage to the 30-amp meter. At present, it costs 17% less than a 50-amp meter. Greater savings are possible as production is increased. In fact, it is already indicated that sufficient production can bring the cost to almost the same as a 15-amp meter.

The 30-amp meter has an inherent speed advantage over the 15-amp meter. The disc revolves just half as fast on any given load. This may have a psychological advantage as far as the customer is concerned, and it definitely has mechanical advantages under heavy loads.

Starting Watts . . . One characteristic of larger capacity meters that may lead to some difference of opinion among metermen is the fact that larger capacity meters require greater starting watts.

A 50-amp meter will not register total loads under about 50 w. A 30-amp meter cuts that minimum to 24 w, while a 15-amp meter registers anything over 12-w total load. Here, again, the 30-amp meter shows an appreciable advantage over the 50. But it suffers in comparison with a 15.

What effect starting watts have on total meter registration is a controversial question. If the total load on a meter is just under the starting watts for say eight hours every day, there would be a loss in registration and in revenue of the amounts shown in Table I.

Possibly this assumption is an extreme case. For the 30-amp meter, it would mean that the customer would have only a 24-w load for 8 hr every day. A lower load or a shorter time of minimum load would decrease the loss in direct proportion.

Loss in Registration . . . Average loss in registration is very hard to determine. There are too many variables. In order to obtain a somewhat more definite answer to the question, we are now conducting an extended test to determine the difference in registration between a 15- and a 30-amp meter on the same customer's load.

A special adapter has been devised which permits the mounting of both a 15-amp and a 30-amp meter on a customer's meter socket installation. The adapter and a typical installation are shown. In practice, this adapter is assembled with a 30-amp meter plugged into the lower socket. The customer's 15-amp meter is removed, and the adapter inserted in its place. Then the customer's 15-amp meter is replaced in the upper socket of the adapter. Thus, a simultaneous measure of customer's load is obtained on the two meters. Both meters are calibrated carefully before the test is begun. Periodic meter readings are taken to determine what difference, if any, exists.

After this test is completed for a number of customers, a more definite answer to the effect of starting watts should be available. The preliminary results to date for only 15 customers, are summarized in Table II at bottom of this page.

The 15 customers average 190 kwhr monthly and show an average —2.9 kwhr difference in registration between the 30- and the 15-amp meters. This initial average of one and a half percent difference in consumption indicates the possibility that the 30-amp meter does have general use. Whether this average will change as more data on other customers is obtained is a question that cannot be answered at present. It may develop that the registration difference may vary in some predictable manner with a customer's total consumption. There is reason to expect that customers with higher total consumption are more likely to have minimum loads above the meter starting watt point. Furthermore, such customers may have their minimum loads on for shorter periods of time. Perhaps our tests will indicate a total consumption above which the 30-amp meter will show no difference at all in registration.

We Are Installing 30-Amp Meters . . . Meanwhile, the Duquesne Light Co has purchased and now is installing 4,000 of these 30-amp meters. This should give us a further basis for our final analysis which, we believe, will lead to the establishment of a purchasing policy of buying only 30-amp meters.

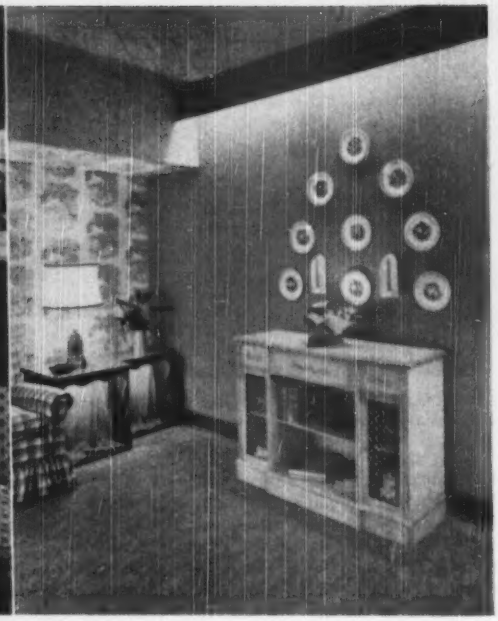
This meter will be used on all services up to 100 amp. On services above 100 amp, the company requires the use of current transformers. Any future requirements for meters for current transformer installations or for low current installations will be satisfied adequately from the large number of 5-amp and 15-amp meters that we now own.

TABLE II—Difference in Monthly Registration of 15-amp and 30-amp Meter On Same Load

Customer No.	Time Days	Kwhr Consumption 15-amp Meter	Kwhr Consumption 30-amp Meter	Monthly Bill 15-amp Meter	Monthly Bill 30-amp Meter	Difference* Kwhr	Difference* Dollars	Percent Difference In Kwhr*
1	28	230.9	237.0	$ 5.03	$ 5.13	+6.1	+$0.10	+2.6
2	39	147.2	146.0	4.60	4.58	−1.2	− 0.02	−0.8
3	39	323.7	324.9	7.60	7.62	+1.2	+ 0.02	+0.3
4	39	163.7	157.1	4.88	4.77	−6.6	− 0.11	−4.0
5	39	149.0	140.5	4.63	4.49	−8.5	− 0.14	−5.7
6	33	133.7	130.6	4.37	4.32	−3.1	− 0.05	−2.3
7	33	268.3	265.4	6.66	6.61	−2.9	− 0.05	−1.1
8	33	195.8	190.7	5.43	5.34	−5.1	− 0.09	−2.6
9	33	147.8	142.1	4.61	4.51	−5.7	− 0.10	−3.9
10	33	181.7	174.7	5.19	5.07	−7.0	− 0.12	−3.9
11	30	144.4	144.9	4.56	4.56	+0.5	0	+0.3
12	30	346.7	342.5	7.99	7.92	−4.2	− 0.07	−1.2
13	30	143.7	144.6	4.54	4.56	+0.9	+ 0.02	+0.6
14	30	137.3	134.7	4.43	4.39	−2.6	− 0.04	−1.9
15	30	135.5	131.0	4.40	4.32	−4.5	− 0.08	−3.0
Totals		2849.4	2806.7	$78.99	$78.21	−42.7	−$0.73	
Average per Customer		190.0	187.1	$ 5.26	$ 5.21	−2.9	−$0.05	−1.5

* Plus difference indicates 30-amp meter higher.

VALANCE LIGHTING means kwhr for this type of installation will burn all evening for decorative effect



CORNICE LIGHTING in test room sheds soft rays over Bavarian fruit plates and adds to general illumination

Home Lighting Test Room Brings Them In

Compact assembly demonstrates features of modern lighting to builders of new homes and to remodelers of old ones

MRS. MARY W. HELD, Director, Home Lighting Division
The Cincinnati Gas & Electric Co

Cincinnati Gas & Electric's lighting test room has proved popular with men and women alike since it was opened to the public. During the first 10 months 961 daytime visitors, exclusive of invited groups, have seen and had demonstrated the various lighting installations. Invited groups have included builders and their wives, electricians and their wives, lamp department personnel and county demonstration agents.

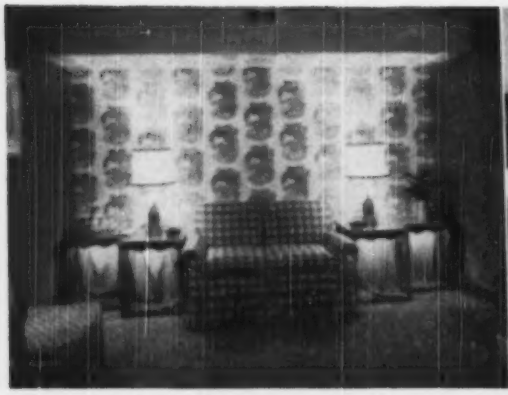
Women were expected to enjoy these new quarters but the number of men visitors, and their reactions, have been a most pleasant surprise. More men come with their wives every month to go over blueprints and discuss lighting arrangements.

Wiring layouts have been made by three wiring advisors for 528 homes. Checkbacks on these homes show that 785 additional circuits were installed. Many of these are attributed to customers being able to see new equipment and new lighting.

On the basis of the over-all experience with the new lighting test room it is difficult to conceive how a space 12 ft sq could be put to better advantage. It is to the home lighting department what the test kitchens are to the home service department. In addition to this, an attempt has been made to:

1. Prove good lighting principles.
2. Demonstrate that a room adequately lighted for the performance of visual tasks can also be pleasingly lighted.
3. Illustrate the advantages of a flexibly lighted room.
4. Show that lighting as an integral part of decoration must receive full consideration when the room is planned—it can no longer be considered a mere accessory.

The lighting test room is in reality a small living room. It is furnished in the popular French Provincial manner. Three sides of the test room have



FOUR COLOR BOXES in form of end tables show effects of different types of fluorescent lamps on colors and fabrics

AUTHOR sits in her office where cornice lighting, ceiling fixtures and lamps make it another demonstration room

been painted in a deep crushed raspberry tone in recognition of the trend in the decorating field toward dark walls. The fourth wall is a figured paper. Light reflection is not sacrificed as much as one would expect with this color scheme. The furniture is both light fruitwood and painted. Draperies are eggshell shantung and the carpet is a very light gray-green. Wall accessories are also very light. True, it was necessary to provide a greater amount of light in cornice and valance installations.

As color is one of the most important factors in decorating, the effect of fluorescent lighting on color and fabrics is demonstrated in four "color cabinets" which also serve as end tables. Each section has been equipped with one of the four whites most applicable to home use. All four boxes have been equipped with the same wattage and have been painted black on the inside to reduce foreign color reflection. Each box has been equipped with a piece of rough-textured green material of the same size. Under the standard white, the fabric appears quite brown; under the soft white, it is very clear; under the 4,500 white it appears clear and fresh; under the warm white it is yellowed. It is not the aim to tell customers which fluorescent tube they should select, but to let them test fabrics under the various tubes and then select the one with which they will be most happy.

Permanent lighting installations have purposely been kept simple—those that can be installed in the existing home as well as the new home with equipment now on the market.

In addition to the lighting test room, the mezzanine floor has a lighting niche. In the niche is displayed portable lighting equipment such as pin up lamps, wallettes, suitable wall brackets for under-cabinet lighting, and desk lighting.

Again there is the lighting office that is also used as a demonstration room. In it cornice lighting has been installed above a figured wall. Cornice lighting in the test room is above a plain wall. In addition to the cornice there are ceiling fixtures and portable lamps. With these three installations, lighting for seeing and lighting for relaxation can easily be demonstrated.

Color scheme in the office is hunter's green, watermelon red, and white. Furniture is very light gray—draperies pick up the watermelon tone.

In redecorating the whole mezzanine floor, an attempt has been made to give it the feminine touch. The departments on this floor deal with home service, home lighting and home wiring. Hence an effort was made to give as much "home atmosphere" as possible.

TEST ROOM LIGHTING

Valance Lighting . . . 1 40-w T12, 4,500 white fluorescent bulb mounted on wall so that the top of the channel strip is even with top of valance board. This type of lighting adds to the general illumination of the room and is most flattering.

Cornice Lighting . . . Cornice was extended 10 in. out from the wall in order to allow the light to spread down over the group of fruit plates above the credenza. This cornice extends the length of the side wall opposite the window, with two rows of tubes, one of 4,500 white and the other of soft white fluorescent.

Spot Lighting . . . 1 150-w R-40 bulb installed above the wing chair provides additional intensity for severe visual tasks, such as sewing. Used in conjunction with the lamp, this chair is provided with 95 ft-c.

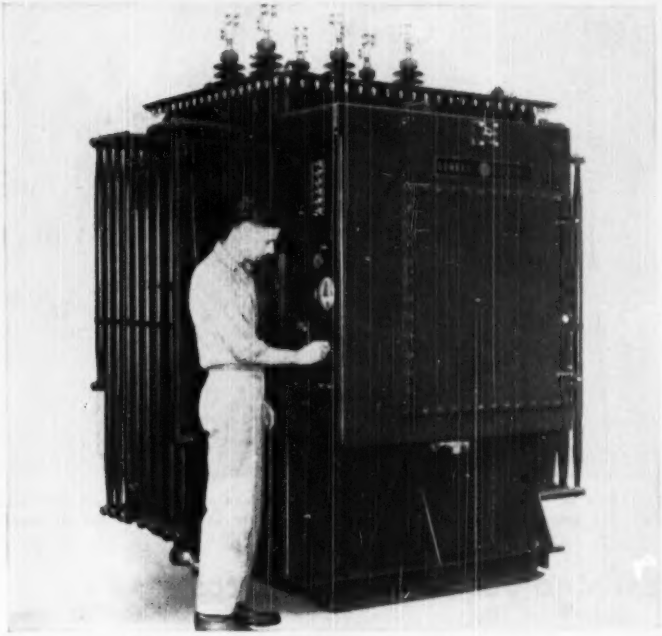
Pin Hole Spot Lighting . . . 1 100-w G 16-½.

Bowl on Credenza . . . 1 40-w tubular incandescent lamp in the milk white bowl, containing fruit sprayed white, raspberry and green. Purpose of this is to show women how they can use light to dramatize their own home settings.

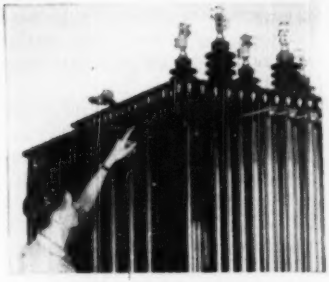
Portable Lamps . . . Both certified and non-certified lamps have been used. The floor lamp beside the wing chair is a certified combination, incandescent and fluorescent. It provides 45 ft-c. End table lamps are certified. The writing table lamp is a Tole which provides 35 ft-c. In conjunction with the valance, the table is provided with 45 ft-c.

NEW STATION-TYPE VOLTAGE REGULATOR

Requires less maintenance **Is easier to inspect**



Now up to 2500 kva in standard ratings. Voltages up to 69,000 volts, 3-phase. 10% raise and 10% lower in 32 equal steps.



Added Oil Life

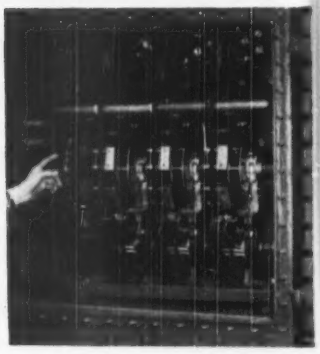
Main tank now completely sealed with Nitrile rubber gaskets. Protects oil from oxidation, sludging, and moisture.

New MLT32 Step Voltage Regulator is now in production. Shipments are short. New design means even lower maintenance, more convenient inspection, easier testing—plus accurate, dependable voltage regulation.

New bulletin, GEC-716, gives full particulars. Secure a copy from your nearest G-E Apparatus Sales Office, or write Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

Redesigned Control Panel Includes

- New simplified voltage-regulating relay with fixed holding coil adjustment.
- New test rheostat for convenient voltage-level adjustment.
- New current-testing terminals.
- New reversing switch for reactance element of line-drop compensator.
- New larger, easier-to-read position indicator.
- A handy utility shelf for instrument.



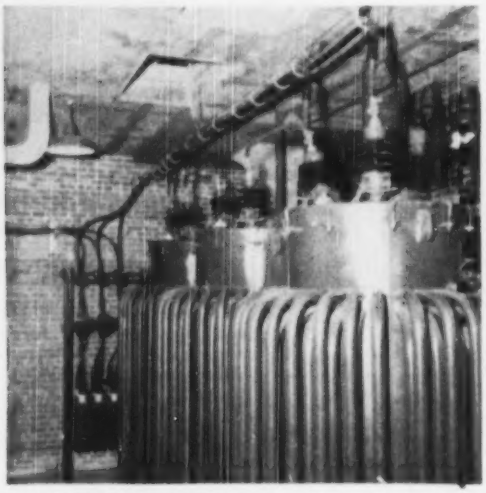
Switch Compartment More Accessible

Large hinged door permits much easier inspection and servicing of an improved switching mechanism.

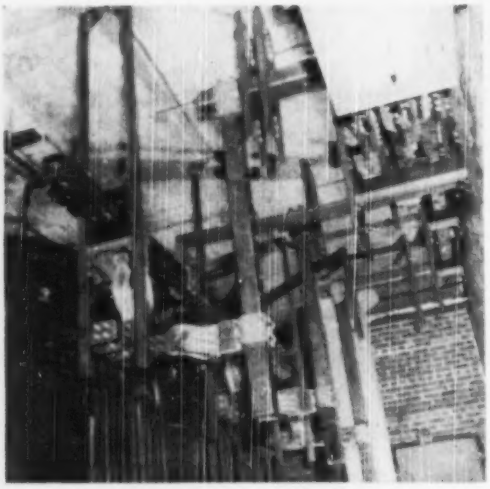
Time-tested Geneva-Gear Drive meets exacting requirements of shockless, quick-break action, accurate positioning of the contacts throughout the switching cycle, and firm locking on each position without latches or brakes.

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



TRANSFORMER PRIMARY bus in vault consists of 11-kv cable hung from cable rings with saddles and messenger



SECONDARY BUS of square ventilated type required 30% less copper than did interlaced bar bus and cost less to install

Square Ventilated Bus Cuts Service Costs

GEORGE LUFSEY
Asst Engineer
Virginia Electric & Power Co
Norfolk

Vepco engineers solved a difficult service problem of supplying power to a new large department store in Norfolk, Va., by using square ventilated bus for secondary service. Use of this bus, along with aerial cable for primary service and a removable copper louvre in the building wall, made possible the completion of vault work as promised and cut installation costs appreciably. Service application was made in September, 1948; overhead and vault were completed and delivered on Jan. 15, 1950. Estimated lighting load for the project was 1,200 kw; power load was estimated at 700 hp.

There were several solutions to the problem of installing the 5,000-amp, 120/208-v secondary bus—interlaced bar bus, solid square bus or ventilated square bus. Square ventilated bus, requiring a 4-in. square bar of ⅛ in. wall thickness, in the order ABCN, and weighing about 48 lb per running foot, was chosen. This bus saved 21 lb of copper per running foot over interlaced bar copper and 17 lb over solid square bus for the same current carried.

Ease of installing square ventilated bus permitted a marked saving in labor cost. Bus supports are made of special channels cut at the factory. Bus is supported in hangers on a 1½-in. slotted ebony asbestos insulating sheet, which will support a working load of 2,000 lb per ft. Concrete inserts were placed on the ceiling forming at the proper locations before concrete was poured.

High compression type, 5,000-amp secondary connectors were used. Flexible braid connectors were used at transformer bushings to relieve any possible stress due to heat expansion of conductors.

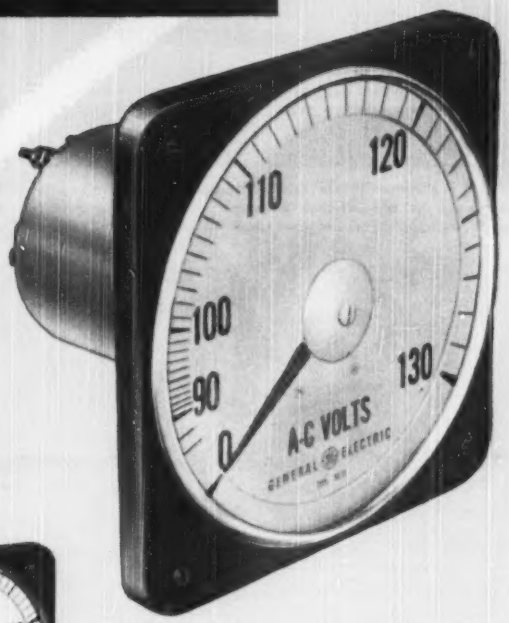
Primary cable for 11-kv service was brought in from the line pole and formed into an aerial cable by using a messenger and cable rings with saddles. Primary bus in the vault was constructed and installed in the same manner. The 11-kv circuit breaker was installed by the power company substation crew.

Vault floor was 32 ft above ground; vault roof slab was 15 ft above vault floor. A removable 5x11-ft copper louvre was provided in the building wall for placing the transformers in the vault. Three 500-kva, 11,000-120/208-v, single-phase transformers were placed in the vault during December 1949. These single-phase units saved approximately $7,000 over three 3-phase units. Installation of the single-phase transformers was complicated by the fact that each unit weighed nearly three and one-half tons. However, through the combined efforts of overhead and underground departments, all work was finished on time.

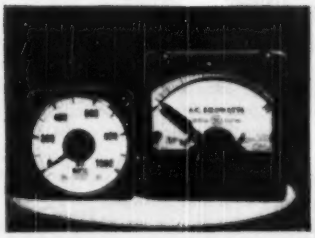
NEW!

SHADOW-PROOF *Instruments*

TYPE AB, DB-16 (8¾-inch)
250-degree scale, 14.2 inches long 1% accuracy



TYPE AB, DB-18 (4½-inch)
250-degree scale, 7.1 inches long 1% accuracy



You can *always* read these two new General Electric switchboard instruments. No more shadows caused by overhead illumination. The dial is mounted flush with the case front and protruding convex glass cover gives maximum readability. The anti-glare glass prevents reflections. For clear, accurate readings, specify G-E long-scale, shadow-proof instruments.

They're available as d-c ammeters and volt meters; a-c ammeters, voltmeters, and watt-meters; frequency and power-factor meters; temperature indicators and synchroscopes. Call your G-E representative today for more information. Apparatus Dept., General Electric Co., Schenectady 5, New York.

COMPARE THE READABILITY • • • THEN ORDER G-E LONG-SCALE INSTRUMENTS • • •

You can put your confidence in—

GENERAL ELECTRIC

603-187

Shallow Incisions Give Durable Crossarm Treatment

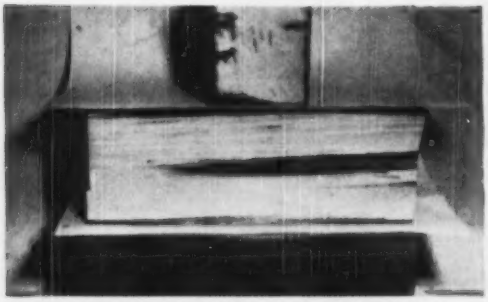


FIG 1—NON-UNIFORM depth of penetration of preservative produced by conventional pressure or non-pressure method adds materially to the cost and weight of the crossarm

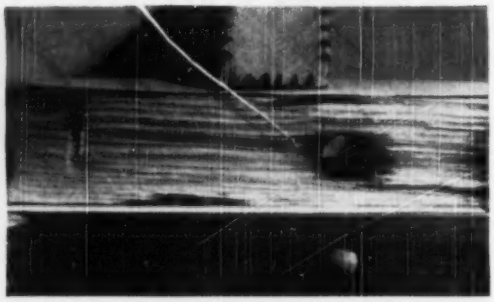


FIG 2—SURFACE INCISION usually used for fir lumber, timber and ties is too widely spaced and too deep to give uniform penetration and low retention of preservative

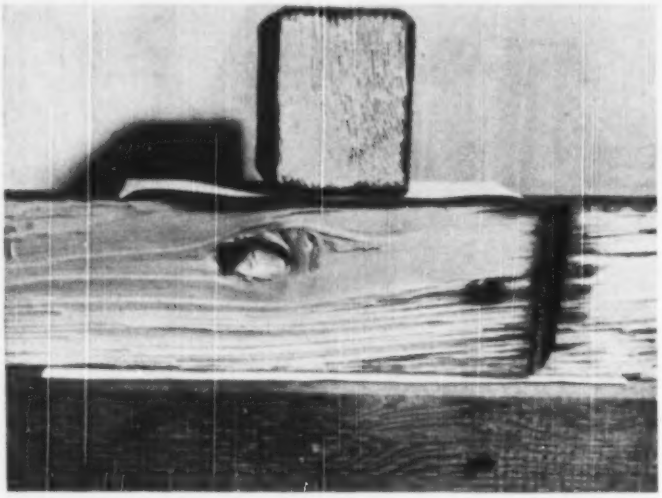


FIG 3—CLOSELY SPACED shallow incisions and non-pressure treating cycles give uniform penetration of at least ⅛ in. Minimum longitudinal penetration from bolt hole indicates that retention of preservative is not excessive

FRED B. DOOLITTLE
Southern California Edison Co
Los Angeles, Calif.

Nearly uniform penetration of preservative has been achieved in all surfaces of non-pressure treated Douglas fir cross arms with the aid of closely spaced shallow incisions used in combination with various non-pressure treating cycles involving hot and cold immersion in preservative. Douglas fir crossarms receiving this treatment have been initially satisfactory on the Southern California Edison system. It is believed that their service life will be as long as that of the full length treated poles on which they are used.

By comparison, conventional pressure and non-pressure treatments of Douglas fir crossarms generally produce these results: Deep penetration in exposed end grain; fair penetration in vertical grain surfaces; little or no penetration in some flat grain surfaces. Split sections (Fig 1) show extensive longitudinal penetration from the bolt hole, indicating that a considerable quantity of preservative is absorbed in the normally unexposed interior of the crossarm. In one single charge, for instance, average retention in 120 10-ft crossarms with 13 bolt holes per arm was 7.5 lb per cu ft whereas it was 10.6 lb per cu ft in 120 8-ft crossarms with 7 bolt holes and 6 (larger) holes for 1½-in. wood pins.

Better penetration in Douglas fir lumber, timber and ties can be accomplished by incising the flat surfaces prior to treatment (Fig 2). However, these incisions are too widely spaced and too deep for uniform penetration.

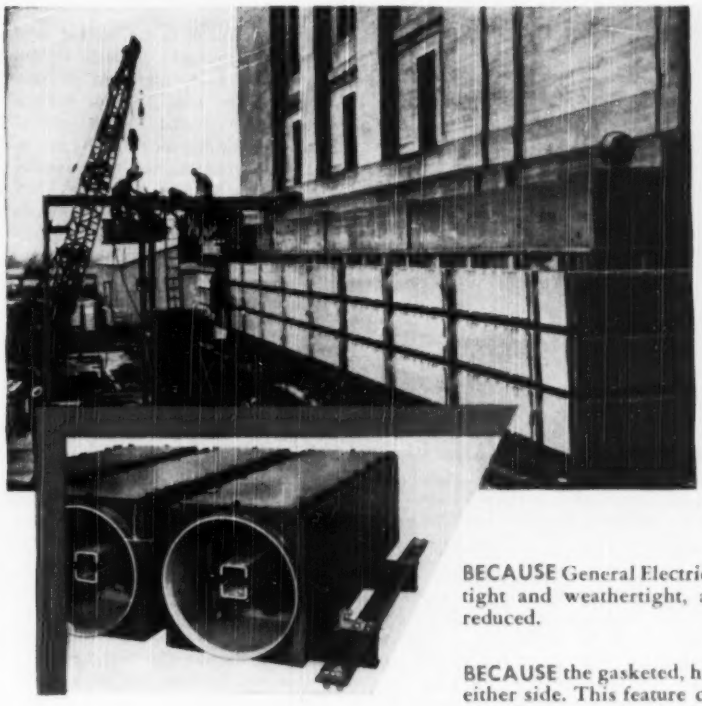
Faced with the problem of non-uniform penetration, Southern California Edison discussed with two crossarm manufacturers the possibility of using closely spaced shallow incisions in combination with non-pressure treating cycles to treat Douglas fir crossarms for a specification requiring not less than ⅛-in. penetration in any surface. As a result of the successful development of this new technique nearly uniform penetration has been achieved in all surfaces (Fig 3) and longitudinal penetration from bolt holes has been minimized. Among thousands of incised cross arms received, very few have been found where there was any question of achieving a ⅛-in. penetration, even after critical examination. Incised surfaces are clean and free from splinters. Lastly, because the incisions average less than ⅛-in deep, they should have no appreciable effect on crossarm strength.

Treating cycle used consists of about 2-hr immersion in preservative at 230 F, a quick change to cold preservative for another 2 hr and a final half-hour hot bath. An average retention has been reported of about 6 lb of preservative per cu ft of wood in 10-ft crossarms with 7 bolt holes and 10 holes for 1½-in. wood pins.

11 of the 16 largest turbine-generators*

use

GENERAL ELECTRIC ISOLATED PHASE BUS RUNS



RATINGS
15 and 23 kv
1200 to 7000 amperes

Your G-E Sales Representative has complete information about isolated-phase bus runs. Ask him for a copy of GEA-5460, a 28-page publication that will aid you in planning your bus runs, or write to *Apparatus Department, General Electric Company, Schenectady 5, New York.*

BECAUSE General Electric isolated-phase bus runs are dust-tight and weathertight, and maintenance costs are thus reduced.

BECAUSE the gasketed, hinged covers can be opened from either side. This feature cuts inspection time and costs by allowing access to the interior of the run from the most convenient position. Cover lugs release the cover without removal of bolts. The cover is swung open on either one of two sets of hinges.

BECAUSE you receive G-E isolated-phase bus runs completely assembled as a three-phase package, including running ground bus. They are installed in a short time at lower predictable costs.

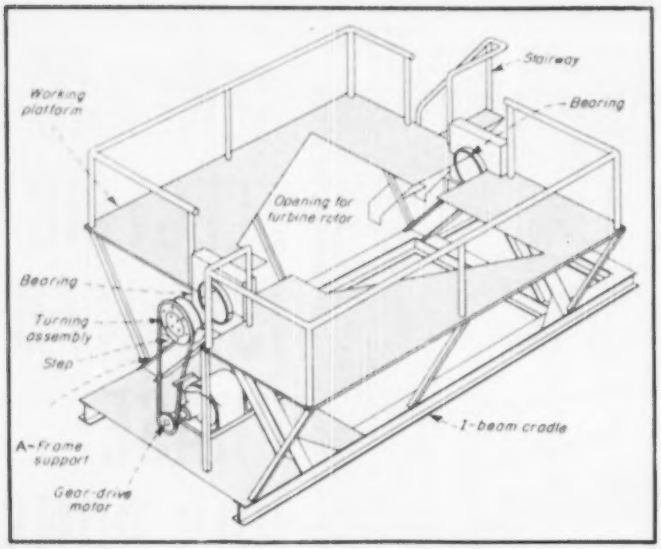
BECAUSE you have one source of responsibility when you order from General Electric—complete co-ordination between planning, engineering, manufacturing, and service facilities to give maximum savings efficiency to the customer.

*Installed and planned, rated 6000 amperes and over.

GENERAL ELECTRIC

Repair, Store or Carry Turbine Rotor in Cradle

W. E. ADAMS
Mechanical Maintenance Foreman
Beech Bottom Power Co
Power, West Virginia



CRADLE for turbine rotor has hole in working platform which follows general contour of rotor. Not shown are shroud-ring punch, small milling machine and other equipment for milling and reblading operations, which are mounted on working platform

Repair, storage and transportation of turbine rotors can be done effectively by using special cradles. This method of handling involves minimum risk to the rotor, saves considerable time and is far less hazardous than the old method of blocking and shoring the rotor with timbers. The cradle illustrated, designed for a 30,000-kw unit, was built with materials salvaged from obsolete equipment and from structural changes.

An I-beam base supports two A-frames, topped by flat plates on which are bolted temporary rotor-bearing assemblies. A working platform at the same level and stairway assembly at one end are bolted to supports so that cradle may be easily dismantled. Working platform has a shroud-ring punch, a small milling machine for milling turbine blades and other tools and equipment for reblading.

Rotor bearings were fabricated from lengths of 12-in. pipe about half as long as the rotor journal. They were babbitted inside and machined to fit the journal. Two steel plates, with centered holes to fit the bearing shell circumference, were welded to the shell about 6 in. apart and at right angles to the axis. Top and bottom plates were welded to the vertical plates and drilled for through-bolts to serve as a yoke and base plate, respectively, when bolted to the cradle. Then assembled bearing was split horizontally. Babbitted bearings are aligned so that rotor will run relatively true. Half-length bearings afford some latitude in the size of rotor to be handled.

To turn or position the rotor, a driving mechanism is provided. This mechanism gives rotor speeds as low as 2 or 3 rpm and can turn the rotor a tenth turn or less. It consists of a reversible 1-hp motor connected through a discarded automobile shift reduction gear, sprocket wheel and chain to a second larger sprocket wheel which attaches to the turbine rotor shaft. For this attachment, a sleeve assembly slides over the stub end of the rotor shaft and is bolted into the holes normally used for governor and oil-pump worm gear. To prevent excessive end-thrust, a thrust collar was welded to the sleeve, and old Kingsbury thrust pads were recessed in two plates bracketed from the front bearing. The driving assembly is mounted at the high-pressure end of the turbine rotor.

When a turbine rotor has to be moved, the cradle assembly is loaded on a flat car and the rotor is transferred directly from the turbine.

Change in Pay Order Saves Accounting Time

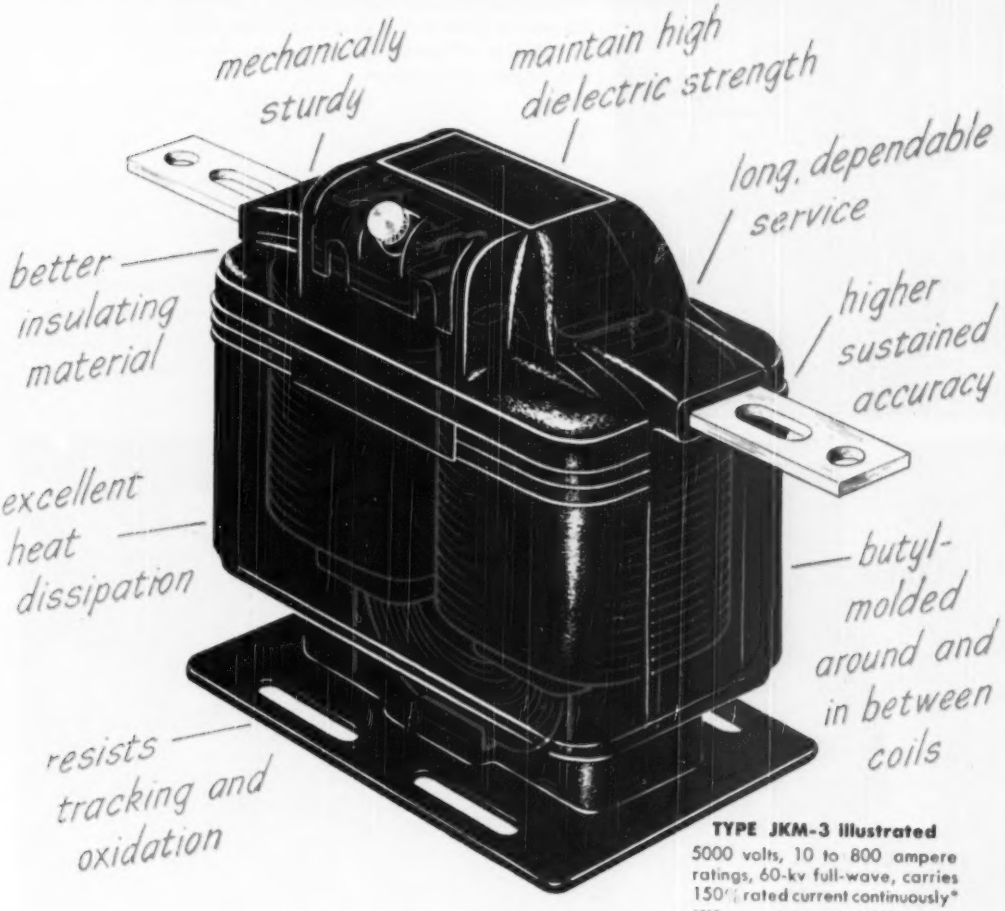
By converting from a paper stock to a tabulating card pay order (pay check) The Detroit Edison Co has made it possible for the auditing department to mechanically sort 11,500 cashed employee pay orders each week into the desired sequence for reconciling in approximately 15 man-hr. The former method of manual sorting required some 33 man-hr. Concurrent with this saving of 18 man-hr is a reduction of 15% in the cost of pay orders. In addition, shorter reorder delivery time reduces quantity storage space and permits immediate design changes without a corresponding high degree of obsolescence.

The use of the tabulating card pay order has facilitated work in the pay roll department by expediting the addressing of pay orders on tabulating equipment. It also has made possible the mechanical enclosing of pay orders in window envelopes for mailing to employees' homes.

Previously, pay orders were printed on tabulating equipment and a set of envelopes were addressed by another machine. The pay orders were then matched with the envelopes, enclosed manually and mailed to employees.

Elimination of the separate addressing operation and replacing of the manual enclosing with a machine operation has reduced the time required by three-quarters—the man-hours required in the pay roll department for these two tasks has been decreased from 40 to 10 per week.

"BUTYL-MOLDED"
Instrument Transformers



TYPE JKM-3 illustrated
5000 volts, 10 to 800 ampere ratings, 60-kv full-wave, carries 150% rated current continuously*
*800-ampere design carries 125%.

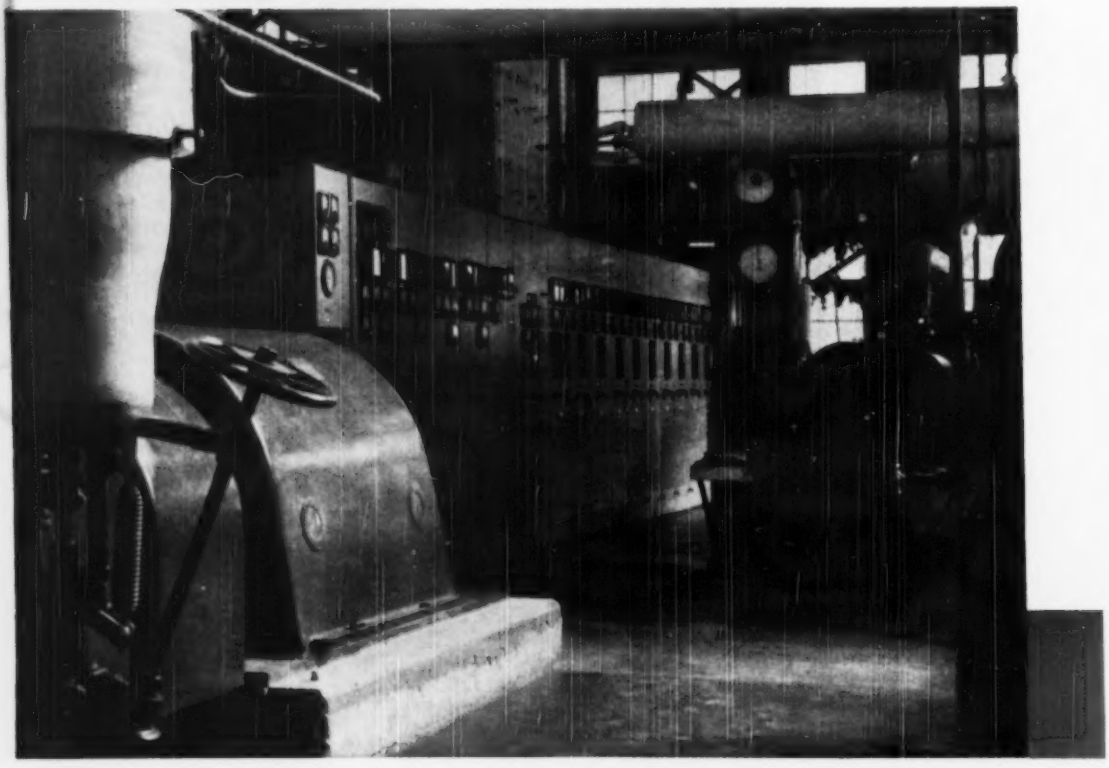
FOR more information, contact your nearest G-E representative today or write for bulletin GEC-497. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

FREEPORT SULPHUR EXPANDS

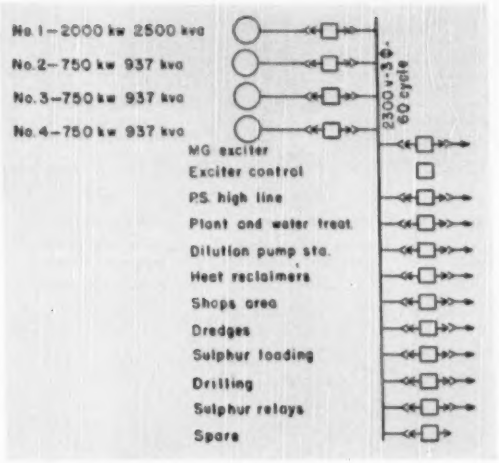
This inadequate, open-type switchgear was replaced by the new G-E Metal-clad equipment shown below. Freeport Sulphur officials recognized that the old switchgear had outgrown its usefulness.

Here's the new General Electric 5-kv Metal-clad switchgear installed at Freeport Sulphur. Magne-blast power circuit breakers have plenty of "IC" (Interrupting Capacity) to handle all short circuits that may occur on Freeport's expanded distribution system. This assures continuous power for vital production.



AND MODERNIZES WITH

METAL CLAD SWITCHGEAR



This one-line diagram shows power distribution at Freeport Sulphur as planned by Sargent and Lundy, consulting engineers of Chicago. General Electric Metal-clad switchgear handles the 2300-volt power from the generators through power circuit breakers of 100,000-kva interrupting rating.

The Freeport installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

Be sure to see the "More Power to America" full-color sound slide-film "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

WHEN Freeport Sulphur expanded their production facilities they put in a new turbine to take care of the increased load.

At the same time they replaced all their old equipment with General Electric switchgear.

When you order G-E switchgear you get all the equipment and service from one reliable source. And with everything pre-assembled at the factory it takes very little time to get the switchgear in place and operating.

MODERN INDUSTRIAL power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want. . . .

- Proper voltage for top performance of equipment
- An extremely flexible setup to take care of expanding or changing loads
- Adequate short-circuit protection
- Protection for personnel
- Low installation and maintenance costs

INVESTIGATE TODAY the many advantages of using General Electric switchgear to get the same benefits gained by Freeport Sulphur. Contact your G-E sales representative for further information—or write for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3083 Metal-clad Switchgear
GEA-4966 Low-voltage Metal-enclosed Switchgear
GEA-3592 Load-center Unit Substations
GEA-3758 Load-center Power Distribution

GENERAL ELECTRIC

Data on Six Mercury Power Plants

Information is provided on seven mercury turbine-generator units with a total rating of 87,500 kw and 280,571 service hours. Three units are operated in topping service, two units in combination topping and process steam, and two units in condensing service

Design and Operating Data for Mercury Power Plants

(Courtesy General Electric Co)

General Plant Data	Hartford Electric Light Co South Meadow Station		Public Service Electric & Gas Co Kearny Generating Station
Date placed in operation	1928	1949	1933
Location of mercury plant	Hartford, Conn.	Hartford, Conn.	South Kearny, N. J.
Type of service	Topping existing steam generating station	Topping existing steam generating station	Topping existing steam generating station
Types of fuels burned	Fuel oil	Fuel oil	Pulverized coal & fuel oil
Mercury turbine-generator rating, kw	10,000	15,000	20,000
Steam turbine-generator rating, kw	.....	.....	.....
Steam output, lb per hr	124,000	210,000	290,000
Total output, equivalent steam and mercury, kw	22,400	34,100	45,000
Mercury turbine throttle condition, psig/deg FTT	70/883	115/947	125/958
Mercury turbine throttle flow, lb per hr	1,080,000	1,640,000	2,200,000
Steam conditions, psig/deg FTT	400/700	400/700	400/750
Total kwhr generated, actual or equivalent, as of Jan. 1, 1950*	1,724,440,686 (Net)	208,342,000	3,105,453,000
Service hours, as of Jan. 1, 1950	119,082.5	7,018	86,603

General Plant Data	General Electric Co. Schenectady Works Mercury-Steam Station	Public Service Co of New Hampshire Schiller Station	General Electric Co Pittsfield Works Power Station
Date placed in operation	1933	1949	1949
Location of mercury plant	Schenectady, N. Y.	Portsmouth, N. H.	Pittsfield, Mass.
Type of service	Topping existing steam generating and process steam plant	Complete condensing power generating station	Topping existing steam generating and process steam plant
Types of fuels burned	Pulverized coal	Pulverized coal & fuel oil	Pulverized coal & fuel oil
Mercury turbine-generator rating, kw	20,000	Two × 7,500	7,500
Steam turbine-generator rating, kw	.....	25,000	.....
Steam output, lb per hr	325,000	.....	124,500
Total output, equivalent steam and mercury, kw	55,000	40,000	20,000
Mercury turbine throttle conditions, psig/deg FTT	125/958	113/944	113/944
Mercury turbine throttle flow, lb per hr	2,143,000	Each 987,000	987,000
Steam conditions, psig/deg FTT	400/750	600/825	625/825
Total kwhr generator, actual or equivalent, as of January 1, 1950*	1,683,786,718	8,852,100	36,426,050
Service hours, as of January 1, 1950	65,180	534	2,154

* Total kwhr based on actual mercury turbine kwhr output plus equivalent kwhr from steam generated, except for Schiller Station which is actual total generation from the mercury and steam turbine units.

"Even *the* UNUSUAL can include *the* CONVENTIONAL"—REVERE

ATMOSPHERIC TOWER OVERHEAD CONDENSERS

Each battery of 6 has a total capacity of 60,000,000 BTU/hr with 18,000 square feet of effective surface. Made by Henry Vogt Machine Co., Louisville, Ky. Revere Naval Brass fixed end plates are 38½ in. diameter by 2⅛ in. thick, floating end plates are 35¾ in. diameter by 2 in.

These Henry Vogt Machine Co. condensers have an unusual feature: vapor belts in the shells to feed more copious and uniform flows of vapor than are obtained by the usual single nozzles.

Inside the condensers, the tubes are rolled into Revere Naval Brass Tube Sheets.

The use of Revere Naval Brass for this purpose is completely conventional in condenser building practice. Revere Naval Brass is corrosion resistant, strong, tough, durable. Every mechanic on the production line knows how to fabricate it. Every maintenance man knows how to treat it when doing a servicing job. Thousands of Revere Naval Brass plates are in daily use in condensers and other heat exchangers built by all the best manufacturers. Some of these plates have been in service for decades.

Revere has alloys for your unusual design features too. Some of these are conventional, made to do unusual jobs because the Revere Technical Advisory Service knows where and when to recommend them. Others are less well known.

When you work out an unusual design you want to concentrate your attention on the unusual features. Under those conditions, use the time tested, service proven, utterly dependable standard Revere alloys in the standard parts of your design and you will be able to forget those parts and keep your attention where it is needed.

For any problem at all that involves the use of metals, consult the Revere Technical Advisors. Their knowledge, skill, experience, contacts (yes, we ask questions as well as answer them) can add up to money in the bank for you.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

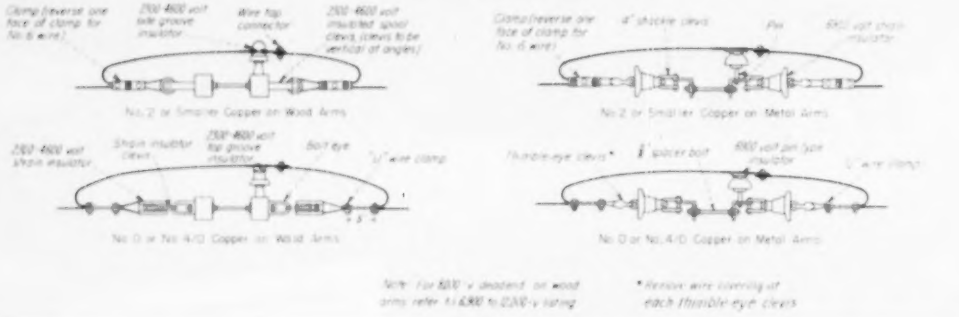
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.

Sales Offices in Principal Cities, Distributors Everywhere.

Dead Ends for Circuits up to 33,000 V

Types of dead ends used on wood and metal arms and for 4/0 and smaller conductors on distribution circuits. List is an adaptation from Distribution Specifications of West Penn Power Co

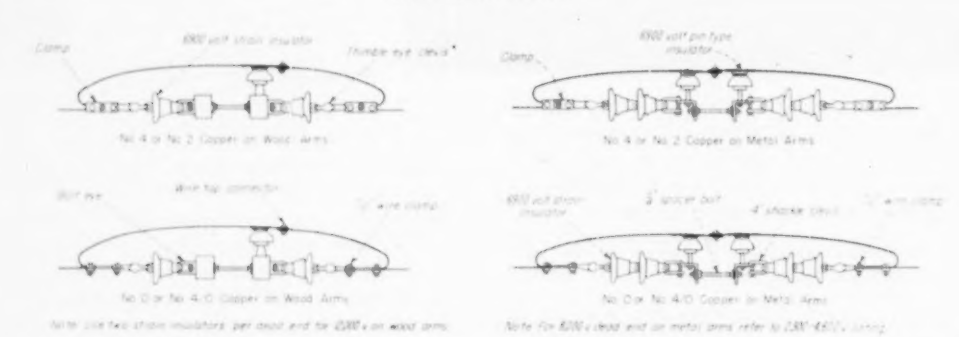
2,300-4,600 V DEAD ENDS
INCLUDING 6,000 V ON METAL ARMS


Clamp (reverse one face of clamp for No. 6 wire)
250-600 volt side groove insulator
Wire tap connector
250-600 volt insulated spool cleats (cleats to be vertical at angles)
No. 2 or Smaller Copper on Wood Arms
250-600 volt shoin insulator
Shoin insulator cleats
250-600 volt top groove insulator
Bolt eye
"U" wire clamp
No. 0 or No. 4/0 Copper on Wood Arms
Clamp (reverse one face of clamp for No. 6 wire)
4" shackle cleats
Pin
6900 volt shoin insulator
No. 2 or Smaller Copper on Metal Arms
Thimble-eye cleats*
¾" spacer bolt
6900 volt pin type insulator
"U" wire clamp
No. 0 or No. 4/0 Copper on Metal Arms

Note: For 600 V deadend on wood arms refer to 4,600 to 2,300-v rating

*Tension wire clamp at each thimble-eye cleat

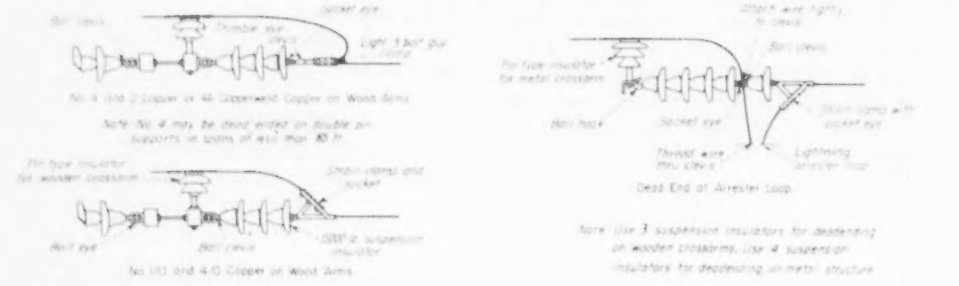
4,900 TO 12,000 V DEAD ENDS


Clamp
6900 volt shoin insulator
Thimble eye cleat*
No. 4 or No. 2 Copper on Wood Arms
6900 volt pin type insulator
Clamp
No. 4 or No. 2 Copper on Metal Arms
Bolt eye
Wire tap connector
"U" wire clamp
No. 0 or No. 4/0 Copper on Wood Arms
6900 volt shoin insulator
¾" spacer bolt
4" shackle cleat
"U" wire clamp
No. 0 or No. 4/0 Copper on Metal Arms

Note: Use two shoin insulators per deadend for 2300-v on wood arms

Note: For 6600-v deadend on metal arms refer to 2300-4600-v rating

22,000-25,000 AND 33,000 V DEAD ENDS


Bell cleats
Socket eye
Thimble eye clevis
Light 3 bolt guy clamp
No. 4, 2 or 1 Copper or 4A Copperweld Copper on Wood Arms
Pin type insulator for wooden crossarms
Shoin clamp and socket
Bell eye
Bell cleats
6900-V suspension insulator
No. 1/0 and 4/0 Copper on Wood Arms
Unjack wire tightly in cleats
Bell cleats
Pin type insulator for metal crossarms
Bell hook
Socket eye
Thimble eye Pin cleats
Shoin clamp with socket eye
Lightning arrester loop
Dead End at Arrester Loop

Note: Use 3 suspension insulators for deadending on wooden crossarms. Use 4 suspension insulators for deadending on metal structure

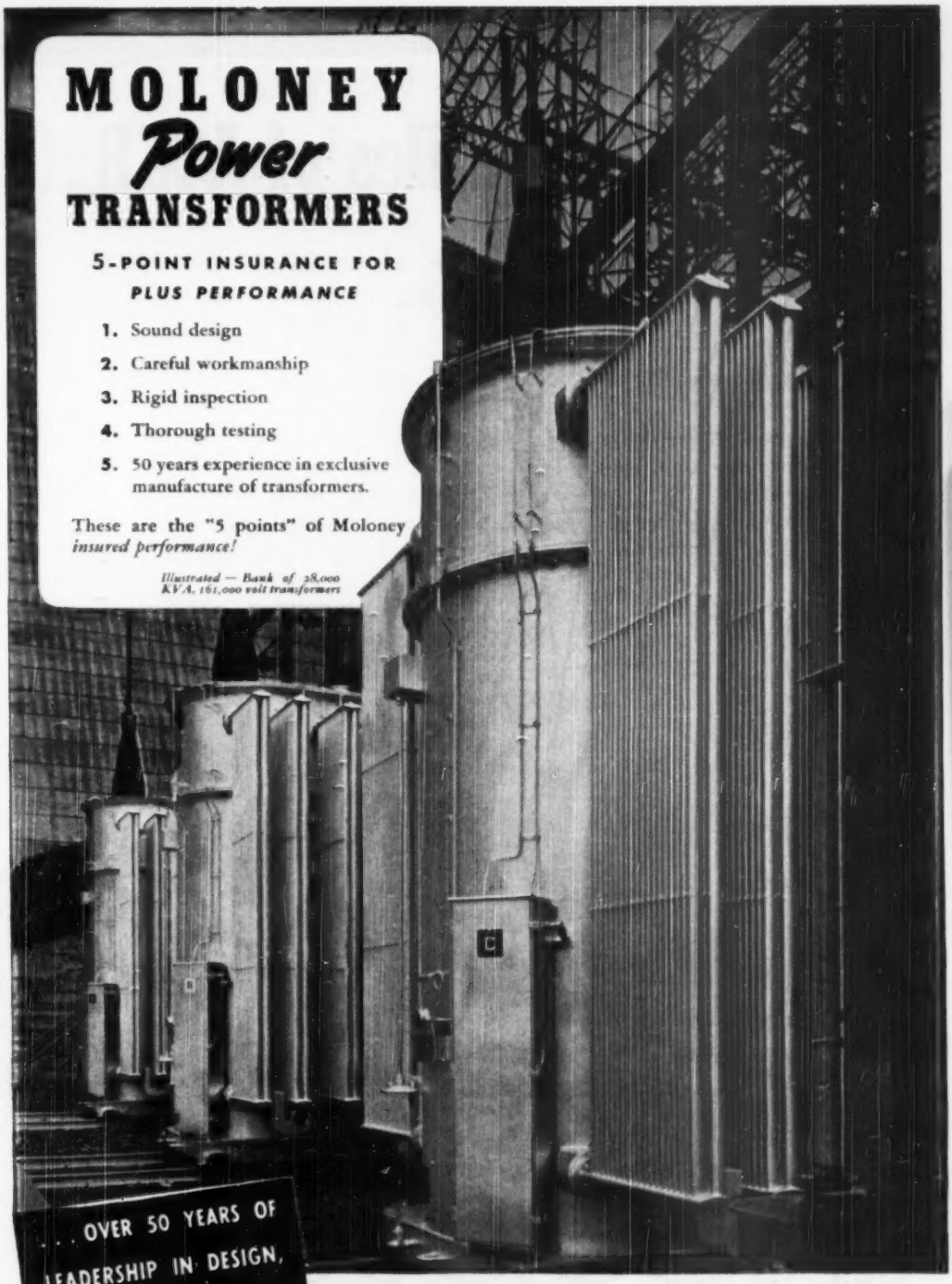
MOLONEY *Power* TRANSFORMERS

5-POINT INSURANCE FOR *PLUS PERFORMANCE*

1. Sound design
2. Careful workmanship
3. Rigid inspection
4. Thorough testing
5. 50 years experience in exclusive manufacture of transformers.

These are the "5 points" of Moloney *insured performance!*

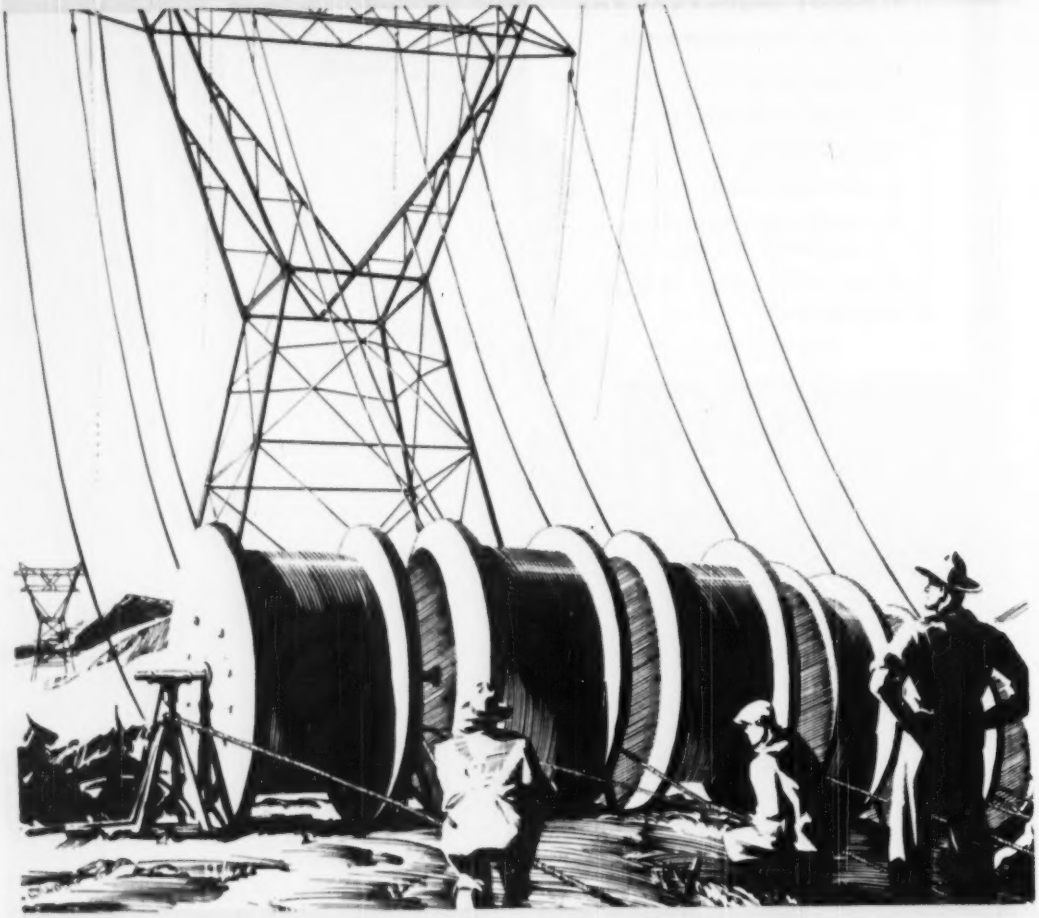
Illustrated — Bank of 28,000 KVA, 161,000 volt transformers



. . . OVER 50 YEARS OF LEADERSHIP IN DESIGN, RESEARCH, ENGINEERING

MOLONEY ELECTRIC CO. ★ ST. LOUIS 20, MO.

2 million miles of ACSR...



ALCOA FIRST IN ALUMINUM

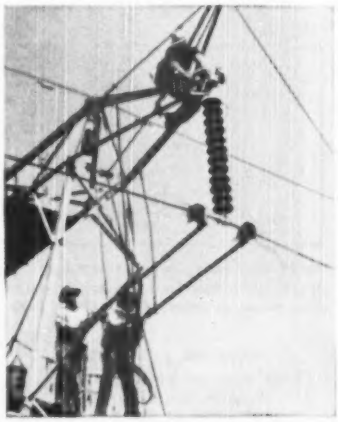
but what do they mean to you?

They mean that you get more than just cable when you buy from Alcoa—that you're tapping the world's greatest store of knowledge of ACSR problems. Think of this:

Alcoa made the first ACSR. Did the research that made possible mile-long spans. Developed the installation methods that made them practical. And today, Alcoa is pushing forward to gain more knowledge of conductor problems.

That means better service from your transmission lines, lower maintenance. It's your assurance that you're buying ACSR from those who can best help you solve your conductor problems. ALUMINUM COMPANY OF AMERICA, 1924M Gulf Building, Pittsburgh 19, Pennsylvania.

Armor rodding—now commonplace—was developed 25 years ago to prolong the life of overhead conductors. Alcoa Armor Rods reinforce cable in the vital few inches of greatest stress, dampen vibration, prevent fatigue rupture of strands. They are also used to repair conductors which have previously suffered damage from vibration, burning or abrasion.



Installing Alcoa Armor Rods with hot-line tools on a 220,000-volt line without interrupting service.

FOREMOST IN A·C·S·R

Ceiling Mounted Welders Save Floor Space

Hanging ac welding machines from the ceiling at the Springfield, Mass., plant of Harvey-Whipple, Inc not only saves valuable floor space but also provides better ventilation and keeps machines from being bumped or jarred.

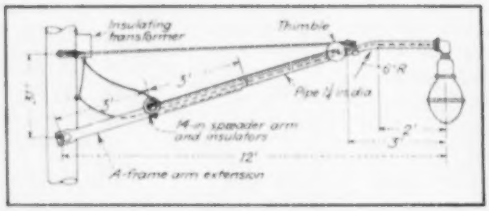
Since long, across-the-floor runs of welding cable are not usually required, the cable is rarely subjected to abuse and lasts longer. By hanging the welding cable directly on the welding machine, the operator has plenty of room to clean his work area of scrap and dirt.

Because of the inverted installation, covers can be removed to facilitate inspection and allow better circulation of the ventilating air. This installation consists of 19 ac welders. Eleven of the machines are suspended from the ceiling at the present time; eventually all the machines will be.

Westinghouse Electric Corp photo

WELDING MACHINES hung from plant ceiling save floor space and provide better ventilation. Machines are not bumped or jarred and welding cables last longer. Covers can be removed to allow inspection and circulation of ventilating air

Lighting Circuit on Mast Arms Clears Trees



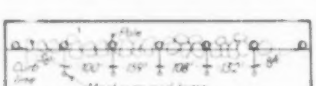
UNORTHODOX construction featured in mast arm. Conductor deadends on thimble, is carried to insulating transformer over insulator on spreader arm. Leads go to lamp head through pipe

MAST ARM carries series street lighting circuit to maintain proper distance from trees and telephone cable. Because of the great height of the trees, lamp is unhindered by branches

HOWARD R. MEANS
Field Engineering Representative
Pennsylvania Power Co
Sharon, Pa.

Series street light circuit, strung directly on street light mast arms, was Pennsylvania Power Co's solution to the problem of installing modern street lights on tree-lined Main Street of West Middlesex, Pa. This method was used because: (1) An underground system was too costly; (2) a multiple circuit was undesirable due to tree conditions which presented difficulties in getting proper clearance between lighting feeders and a telephone cable on existing poles; (3) any other method was bound to involve weaving the circuit in and out of the trees; and (4) residents did not want trees cut down.

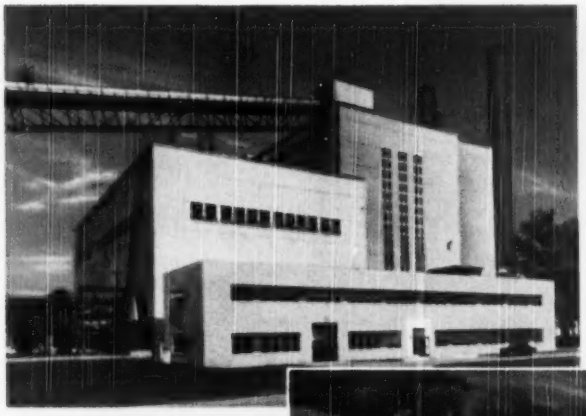
In contrast to the former installation, which consisted of a few 2,500-lm lamps on long spacings and located at alleys intersecting Main Street, with a circuit brought to the light through the alley behind it, the new installation involves 6,000-lm lamps on closer spacings, in many cases halfway between alleys. Upsweep 12-ft pipe type mast arms are used. A half section of a three-bolt clamp was bolted to an outdoor insulator base. This assembly then was fastened to the mast arm by means of a U-bolt. To provide means of breaking the circuit and to allow clearance from the mast arm, 6-in. suspension insulators were attached to the ends of the guy clamp. Thimbles were used instead of deadend clamps, thus reducing weight without sacrificing strength. The circuit is carried back toward the pole on 17.5-kv insulators on a 14-in. spreader arm. From there it connects with an insulating transformer (6.6—20 amp) mounted on the pole.



CIRCUIT on mast arms bypasses trees. Typical span lengths in feet are shown

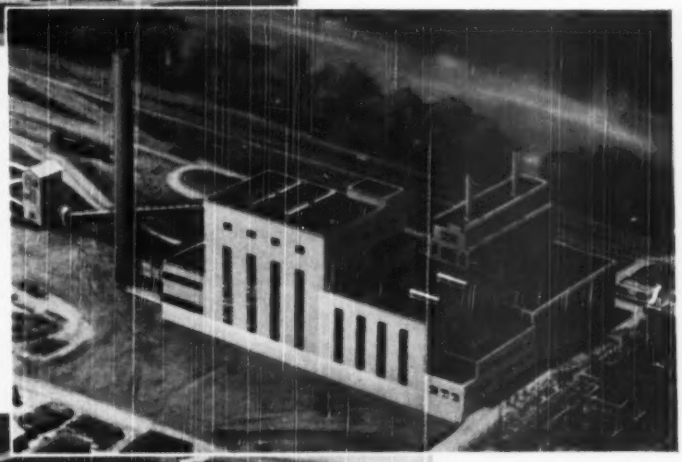
Secondary leads are brought down the pole to a house knob, thence outward through the pipe of the mast

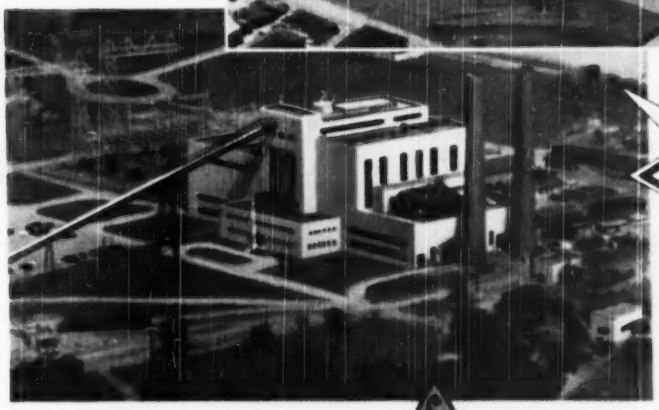
WITH THE NEED CAME THE POWER



Virginia Electric and Power Company instituted an expansion program in 1944 to more than double their electric generating capacity. These new power stations and extensions, three of which are illustrated here, are outstanding examples of efficient design for consistently reliable year-in, year-out, high-capacity performance. Facilities for this program, completed and in process of completion, will produce a total of approximately one-half million kilowatts. Design and construction are by Stone & Webster Engineering Corporation.

1. *Chesterfield Power Station, first with an installed rated capacity of 50,000 kw, has been extended with an additional installed rated capacity of 60,000 kw.*
2. *Recently completed Bremo Power Station extension 60,000 kw rated capacity.*
3. *Possum Point Power Station where an extension of 60,000 kw rated capacity is under construction.*





VEPCo

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

puttin's a breeze . . .
his mind's at ease

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arm itself to the street lamp head. Since spans are relatively short, no mechanical failure is expected, even if the wires should break between mast arms.

New lights went into service on April 14, 1950 and have given no indication as yet of possible trouble. Installation presented no problem. The line crew used a platform-ladder truck to sag the line.

Ground-Level Transformers Supply Series Lighting

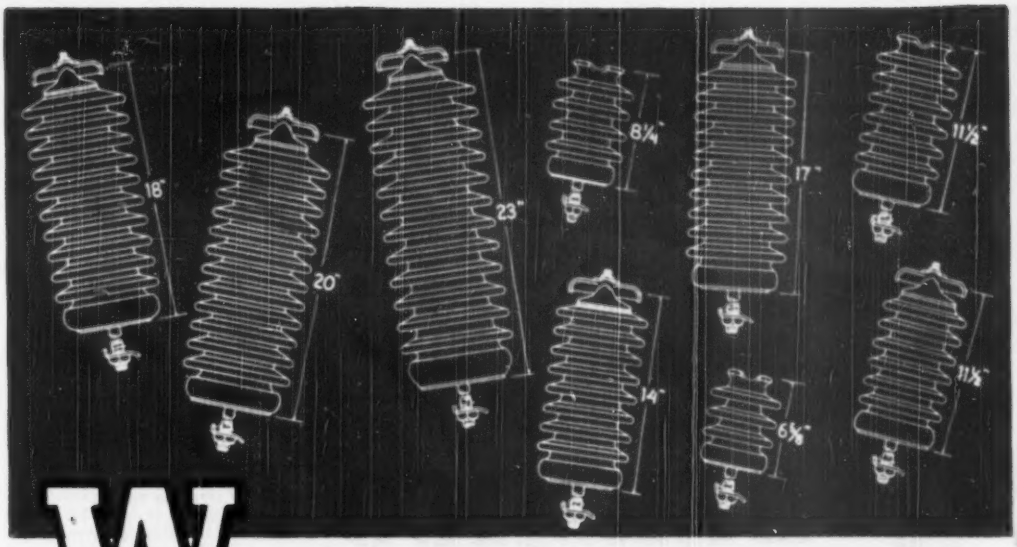
TRANSFORMER on concrete slab provides inexpensive and easy-to-maintain source of supply for highway series circuit lighting. Two such units are used

S. P. SAWYER

Electrical Engineer
Fitchburg Gas & Electric Light Co
Fitchburg, Mass.

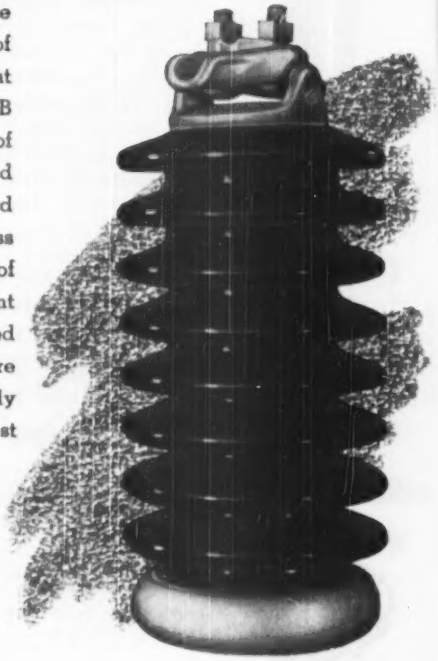
A simplified layout employing two 20-kva constant current transformers supplies mercury vapor lighting along a new highway. All cables are buried directly in the ground except under the roadway, where they are laid in conduit. Polyvinylchloride covering is used for the series circuit cables and rubber-neoprene for the 2.4-kv primary supply. Completely self-contained transformers are used, the only additional equipment being a single primary cut-out mounted on the transformer.

The expense of installing and maintaining manholes for these transformers was avoided by providing a concrete slab base and a removable steel fence inclosure. It is expected that such an installation will be more accessible for maintenance during winter than would a manhole installation.



WHATEVER POST YOU NEED ...IT'S IN O-B's COMPLETE LINE

Post users will find in the O-B Catalog a complete range of line posts covering the entire requirements of both distribution and sub-transmission voltages, but this isn't the whole story. In the many years that O-B has manufactured posts, starting with the early days of this design, these insulators have had the unequalled advantage of O-B's research facilities directed toward obtaining the highest level of performance in this class of insulation. To improve promptness and volume of deliveries, a considerable portion of O-B's recent million-dollar plant expansion program was devoted largely to the most modern facilities to manufacture posts. Sound value is now backed by adequate supply of a line post that carries O-B's reputation for the finest in insulation--ready for your next line!



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Speed-up

RACEWAY RUNS WITH

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Running a raceway can now be done much faster and easier—because when you use Bermico Fibre Conduit you can do cutting and tooling right on the job! Its 8-foot lengths are light . . . easy to handle . . . speed-up installation.

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Bermico's **Complete Line of Bends,** plus 5° angle couplings, enables you to meet unusual field conditions.

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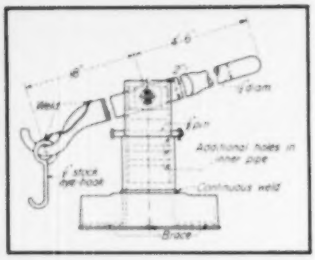
Remove Manhole Covers With Bar and Hook Lifter



LIFTER for removing tight manhole covers allows workmen to do the job without undue effort. Additional holes in inner pipe (drawing) permit vertical adjustment of fulcrum for very tight covers

R. L. SPENCER
Lead Draftsman
Distribution Dept
Appalachian Electric Power Co
Roanoke, Va.

A new device for raising manhole covers has been designed to remove covers with a safe amount of effort by the operator. This lifter will take out covers that are too tightly sealed by asphalt to be opened by a man with normal strength working a conventional bar-type puller. It can be operated by one man, an additional advantage when immediate assistance is not available.

Consisting of a lever mounted on a rotatable fulcrum, the lifter has a tempered hook which slips through the hole in a cover. The lever is supported by a vertical pipe rotating within a larger pipe, which, in turn, is supported by a base made from a discarded brake drum.

Roll Chart Holders Save Time and Space

To aid in analyzing roll charts and to conserve space in storing them, roll chart holders were developed by Claude Harris, relay engineer for Duke Power Co, Charlotte, N. C. Each holder holds eight charts. Holders are set upright on table and charts can be easily unrolled for analyzing;

MEMO

SAM:

This is something for us to think about.

Would it mean all our primary deadends would have to be changed if we cut over to 12 kv instead of 4 kv ?

Jack:
No! When the cut over was first considered we standardized on this deadend assembly

2 O-B 6 inch Suspension insulators

O-B universal clamp

Now our deadends are ready for any voltage increase up to 12.5 KV without further rebuilding

P.S. These O-B items are available from the local Graybar house at l.c.l. prices delivered

TECHNICAL NOTES

ARCHER E. KNOWLTON

Conversion from 2.3-kv delta to 4-kv wye involves adding a neutral which is very handy when subsequent conversion to 12 kv is indicated—why not 12 kv at once?

Internal radiation from radioactive wastes that find their way into the human body constitutes the principal problem for atomic power safety. Plutonium, fortunately, is practically not absorbed.

Steam at 3,000 psia and 1,600 F would ideally surpass 1,250 psia/950 F by 15.7% in thermal performance, and this might justify an added $15 per kw outlay for the equipment—provided the metals were available.

Human organism resistances stand in the following relations to muscle as unity: nerve and cartilage 2 to 3, bone 15 to 20, and skin 50 to 100. Feminine skin is one-tenth as resistant (electrically) as masculine—not moist the latter may be 8,000 ohms per sq in.

Bushing capacitance is no longer considered to be something that makes arresters unnecessary for lightning protection of transformers.

Plastics and synthetics may not cure properly if the heating is too short or too fast. In cellulose fabrics the temperature rises sharply after the moisture has been reduced to small percentage.

May 1, 1950 • ELECTRICAL WORLD

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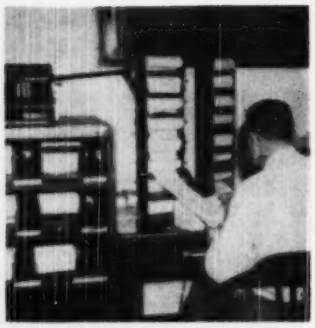
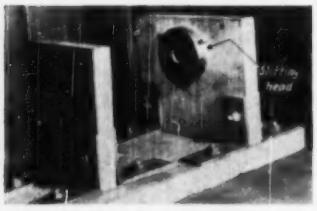


CHART HOLDERS aid analyzing roll charts. Holders stand upright permitting rolling and unrolling charts. Note storage cabinet (left) for additional charts

small handles aid in rerolling. Each holder carries a large identifying number which projects from storage cabinet for ready selection.

Recover Aluminum Wire With Insulation Stripper



INSULATION STRIPPER consists of a slitting head and a stripping head mounted separately on braced standards. Stripping head is mounted on the far side of the standard in the foreground

FRED C. JACKSON
Storeroom Helper
The Ohio Power Co
Bellaire, Ohio

A device which slits and then strips insulation from wire is now used to salvage aluminum wire insulated with Neoprene rubber. The device consists of a slitter and a stripper mounted on separately braced standards attached to a heavy base. The slitter consists of three ¼-in. carbon-steel cutting tools held radially 120 deg apart. These tools split the insulation longitudinally into three parts when the wire is pulled through. The stripper is a steel plate with a hole in the center drilled to the exact diameter of the bare wire. This plate removes the split insulation cleanly and easily when the wire is pulled through the aperture.

Utica Lubring Pliers..

with built-in lubrication

LUBRING pliers have a ring of porous, oil-impregnated iron in the joint. This ring carries no stress but feeds lubrication to assure a smooth, free-working joint.

Linemen like their "heft" and feel and power... management likes their long-run economy.

Also available with splicing grooves (No. 2595)

UTICA Drop Forge & Tool Corporation
Utica, 4, New York

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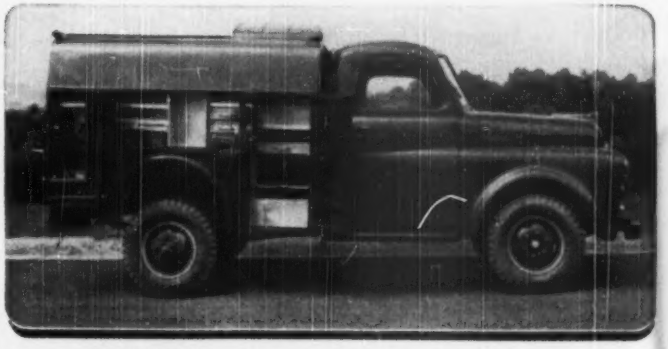
YORK-HOOVER

Service Bodies SAVE MONEY for YOU because



Model 2040

York-Hoover Line Service Bodies, for installation on ¾-1 ton chassis, are provided with complete working equipment.
Years of study and engineering experience have indicated the most adequate body interior arrangements so that all necessary service materials and tools are at the service men's fingertips.
There is a York-Hoover body design to meet your particular requirements and we will be happy to give you all details.

Write now for the York-Hoover Public Utility" catalog.

1. All-metal body structure is balanced to produce minimum weight.
2. Exclusive body framework and assembly details result in many extra years of service.
3. Construction includes replacement parts study for maintenance economy.
4. Details of convenience for driver and garage personnel carefully considered.
5. Your body is engineered for your specific job — and yours alone.

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INDUSTRIAL • COMMERCIAL
RESIDENTIAL • RURAL

Utilities, Too, Can Benefit from Better Lighting

AFTER RELIGHTING, properly distributed illumination of up to 100 ft-c was achieved compared with 25 ft-c under original system. Each fixture is suspended 12 in. from ceiling and contains two 75-w T-12 96-in. Warmtone fluorescent lamps. Concrete results showed a 2.4% increase in production as the return upon a 0.3% increase in total lighting expenditures. Daylight-darkness transition is unnoticed

WARREN K. LEWELLEN
Power Sales Engineer

JOHN W. YOUNG
Lighting Engineer
New England Power Service Co

Improved lighting often brings internal economic benefits to the electric power company, aside from its value as an additional sales tool. Take the case of the drafting room of New England Electric System's Boston, Mass., office. Here increased production amounted to eight times the increase in lighting costs.

Original lighting, provided by the building owner, produced only 25 poorly distributed ft-c despite windows on three sides and a 9 ft, 3 in. ceiling. Shadows on the drafting tables created an uncomfortable seeing condition. Fixtures were luminous indirect 300-w incandescent, spaced four to a bay over the 3,100 sq ft of floor area.

The chief draftsman found that, on the average, one-half hour of production time was lost every working day of the four winter months. When additional space became available to the company last summer, and it was decided to move the drafting room, this loss of time was evaluated. Loss in production time was found to be equivalent to 2.4% of the annual production time.

Continuous Rows Spaced 4½ Feet

The lighting installation chosen after design and study with engineers of Sylvania Electric Products, Inc, consists of that company's 8-ft louver-shielded fluorescent fixtures on 12-in. stems. Each fixture contains two 75-w T-12 Warmtone lamps. They extend the length of the room in continuous rows parallel with the ceiling beams. Rows are spaced 4½ ft apart. Additional rows are installed perpendicular to the principal rows and about 2 ft from the end walls to even up light distribution.

Fears that brightness of the installation would cause a bad psychological reaction were unfounded. After ten months operation without cleaning, the lighting level was 80 ft-c. It is expected that cleaning at 3-month intervals will maintain an illumination level near 100 ft-c.

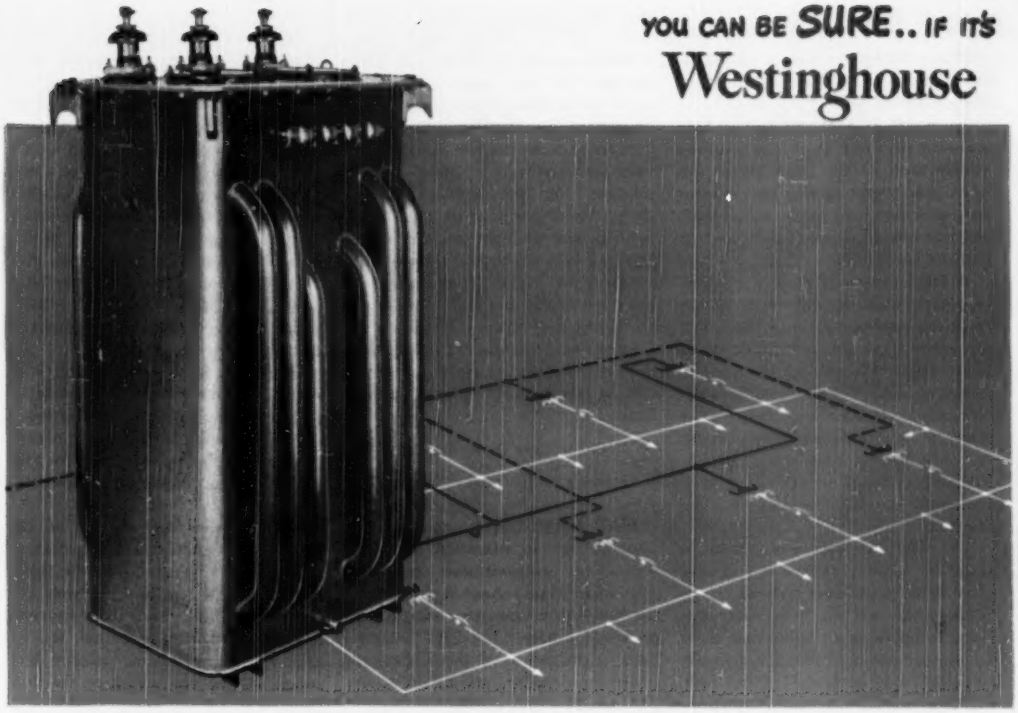
Annual cost of the new lighting system, including fixture depreciation, is almost twice that of the old system—or approximately 0.6% of the entire annual cost of the drafting room. However, the increase in cost of lighting, 0.3%, is but one-eighth of the 2.4% increase in production time gained from the improved lighting.

Lamp Wattages Increased Through R-40 Promotion

More than 1,000 lamps of 25, 40 and 60 w were changed to the 150-w R-40 bulbs in a seven-month promotional activity in the area covered by the home lighting advisors in the Dayton office of Dayton Power and Light Co. In some domestic consumer's floor lamps, 200-w bulbs were installed. Many of the lamps converted were not in use and these represent an even greater increase in wattage added to the lines.

All of this was accomplished with four home lighting advisors working on this activity four days a week, the

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



EXTEND NETWORK ADVANTAGES
to "Borderline" Areas

Where areas of your system make it difficult to justify an underground network, Westinghouse Type "S" Transformers help make economical overhead networks possible. Thus, the advantages of greater service continuity and system flexibility can be extended to heavy-load residential sections, light business districts and similar "borderline" areas.

No matter what type of network system you plan, or what your installation problems may be, Westinghouse can help you keep costs down . . . now . . . and in the future.

HERE'S WHY:

Now—There is a Westinghouse Network Transformer specifically designed to answer each of your network problems. In addition to TYPE "S", there are LIQUID-FILLED (oil or Inerteen®), most economical for general use; "ASL" VENTILATED DRY-TYPES, ideal for indoor service; and SEALED DRY-TYPES, the safest transformers ever built. Standardized construction provides lower initial cost and lower installed cost, too. Special hook-up problems are eliminated.

And in the Future—Years of leadership in the design and construction of network transformers show in the high quality and maintenance-free operation of Westinghouse Transformers. In addition, our complete facilities . . . engineers and calculating boards . . . are available to help you in your network planning, to make future expansion more economical.

Ask your Westinghouse representative for further information, or write for Booklets B-4082 and B-4002-A. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70559

Westinghouse
NETWORK TRANSFORMERS

fifth day being devoted to callbacks. Advisors also had "time out" for request calls and special activities.

Since the R-40 lamp has a 5-in. diameter envelope, each sale required modification of the lamp. Each advisor was taught in two easy lessons how to remove old harps, install wide harps or clip on shade holders, and reconnect sockets.

A different part of the city was covered each week. Sections were chosen to give a good sampling of the different income groups and to cover as many different localities as possible. Areas covered include housing projects, apartment houses, older homes in lower, middle, and high income brackets, new homes, even trailer homes. The activity is now being carried on in the small communities surrounding Dayton.

The four advisors work from a single car which is parked in a central place in the area being covered. Each advisor fills her kit and starts out house to house. Since housewives have no advance notice of the campaign, all calls are "cold contacts." From four to seven successful calls per day is the average for each advisor. In some cases the advisor merely leaves a card or arranges for a future call.

After introducing himself, each advisor gives the regular lighting demonstration. The housewife is told and shown the importance of good home lighting, and the light intensity in her living centers is checked by means of a light meter. Necessary recommendations are made, and then the advisor breaks the R-40 story—"Since new developments are constantly taking place in home lighting, I have something new we think you'll be interested in seeing. . ."

On-the-Spot Demonstration

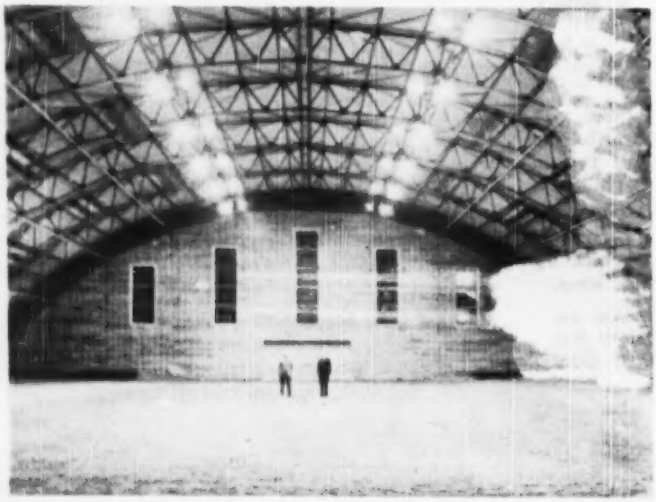
Having seen the amount of light her present lamps are giving, the housewife's interest is aroused. Each advisor carries an extension cord and socket for demonstration purposes. The owner's lamp shade is placed over the R-40 in the extension, using a clip-on shade holder. The light is measured, a discussion of the advantages of the bulb follows, and a sale is usually made. If there are two end-table lamps, the advisor usually attempts to convert one of them. This always results in the other being converted.

The lamp is then converted with a clip-on shade holder, a conversion basket, or the wide-type harp, whichever is best suited to the lamp. Any minor repairs to the plug, the cord, or the switch are also made at this time. Advisors have found it necessary to carry a stock of finials, reducers, shade risers, new sockets and a miscellaneous assortment of equipment.

After one lamp is converted, it is not uncommon for the housewife to request the conversion of one or more additional lamps. The advisors accept charge sales, with either a one or two month billing. Most sales, however, are for cash.

This promotion of the use of the R-40 lamp in modernizing the domestic consumers' existing portable lighting equipment has been so well accepted that it has justified the expense of the home lighting operation. By the time the home lighting advisor has completed the conversion of the first lamp, with the aid of the housewife, all barriers are broken down between the consumer and the company's representative. From there on the demonstration is conducted on a very amiable basis with profitable results to the consumer as well as the utility.

Unique Lighting Featured In Fieldhouse



Westinghouse Electric Corp. photo

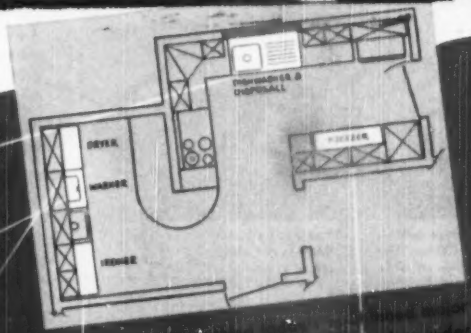
THE University of Delaware fieldhouse, a former aircraft hanger, moved piece by piece from California, is lighted by 64 1,000-w floodlights installed in an unconventional arrangement. Installed in two rows of groups of four and mounted on the bottom of the structural steel trusses at the normal truss spacing of 18 ft, the floodlights produce an average lighting intensity of 35 ft-c over the entire 142 by 162-ft area. The two rows are spaced 40 ft apart, or 20 ft each side of the center line of the building. The vertical illumination component in the main playing area is 40 ft-c at the center, 30 ft-c under the units, and 10 ft-c at the outer rim of the cinder track

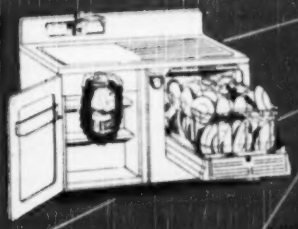
Load Building Notes

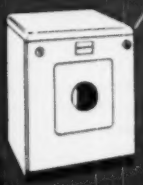
• In 4 months—May 15 to September 15—Appalachian Electric Power Co added 18,031 ranges, 6,363 water systems, and 6,898 water heaters to its lines. Sales to rural customers accounted for 48.8% of the ranges, 94.6% of the water systems, and 46% of the water heaters. This was the result of a "Going Places" sales campaign in which quotas were exceeded by 72% for ranges, 296% for water systems, and 10% for water heaters.

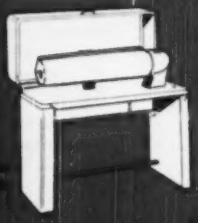
• Domestic refrigeration with gas may be more of a competitor in a year or two. The Servel gas unit, only one on the market now, is at somewhat of a price disadvantage against the electric refrigerator. But that situation may be changed when retailers begin showing a new gas machine which Clayton & Lambert Mfg Co expects to announce soon.

Hotpoint offers Utilities future Load Insurance with its development of All Major Appliances for tomorrow's.. All Electric Home









Hotpoint LOOKS AT TOMORROW TODAY

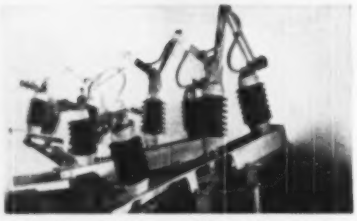
UTILITY DIVISION
Hotpoint INC.

ICE PROBLEMS? Read This...

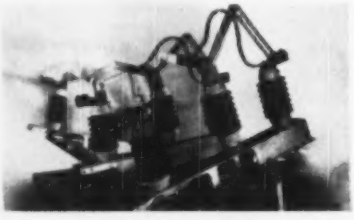
This Chance three phase type WN Switch, with standard controls, was coated in the closed position with over ¾" of hard, clear (bubble-free) ice made with distilled water slowly sprinkled on the switch at various angles to simulate the most severe conditions.

No other switch offers so many operating advantages

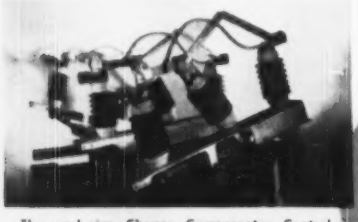
CHANCE* WN-VN



"Torture rack" tests proved that performance of the Chance Type WN Switch is not affected by any conceivable warpage of cross-arms. Note side of base is cut away to show control operation.



Note that each switch unit is closing independently of the others. Standard controls were used and no extra leverage was applied. Switch operated easily in spite of the most extreme distortion.



The exclusive Chance Compensator Control mechanism brings all three blades of the switch into completely closed position. No switch or control adjustments were required to compensate for this extreme distortion.

You get top performance under all conditions plus many time, money, and labor saving features when you buy the new Chance WN or VN Gang Operated Switches.

You save on installation because the flanged bases are easy to mount on cross-arms and the interphase shaft can be laid in position after the switch units are mounted—no threading of the shaft is required.

You get dependable operation under all conditions of climate or stress. The exclusive Compensator Control mechanism is housed under the switch base, protected from the weather. This control operates each switch unit independently so that each blade in a three pole switch makes complete contact regardless of warping, twisting, settling or bowing of the wood supporting structure.

A new "crow-bar action" blade, plus the *extra leverage* of the weather protected Compensator Control, makes Chance WN or VN Switches your best buy for performance under heavy ice.

Maintenance time is negligible with WN or VN Switches because all bearings are lifetime lubricated, the flanged bases don't cut into the wood supports and loosen the bolts, and the switch performs properly regardless of structural warpage.

The Compensator Control prevents shock to the insulators and damage to the switch blade in closing, because the closing action is reversed when the control goes through toggle on each individual switch unit. *Slamming the switch closed will not break insulators.* Heavy castings and extra rugged construction also mean long service life without maintenance.

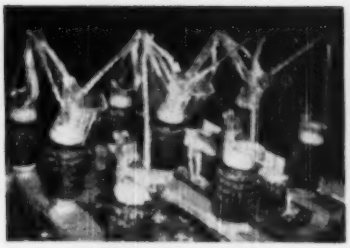
For reliable switching under all conditions, plus time saving installation advantages, specify Chance Type WN or VN Switches. Write for complete information and prices.

***AVAILABLE JANUARY 1st, 1951**

Warped Cross-arms don't affect WN or VN

You know

Various tests were made at temperatures from 20° F. above zero to 16° F. below zero. After 12 hours of sprinkling, hard blows with a hammer only chipped the ice, leaving a white mark. Yet, one man at the controls opened the 3 phase switch without difficulty.



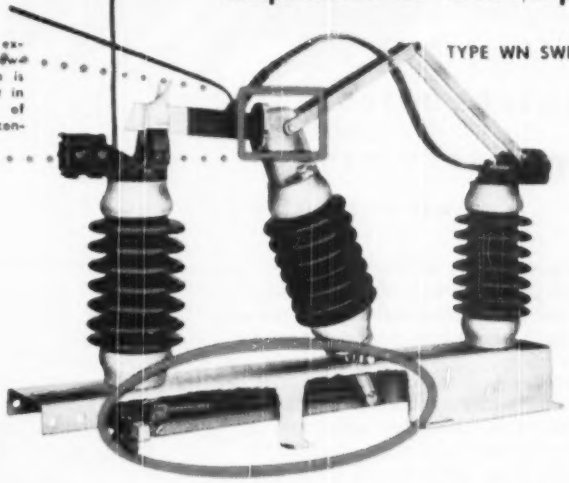
The switch was cleaned and iced again in the fully open position, under the same conditions, with over ¾" of ice on all moving parts of the switch and controls. Operator (background) has started the closing movement.

With standard controls one man closed the three phase switch completely with four chopping blows of the blade. There was no damage to the switch in either of these tests and performance was completely satisfactory.

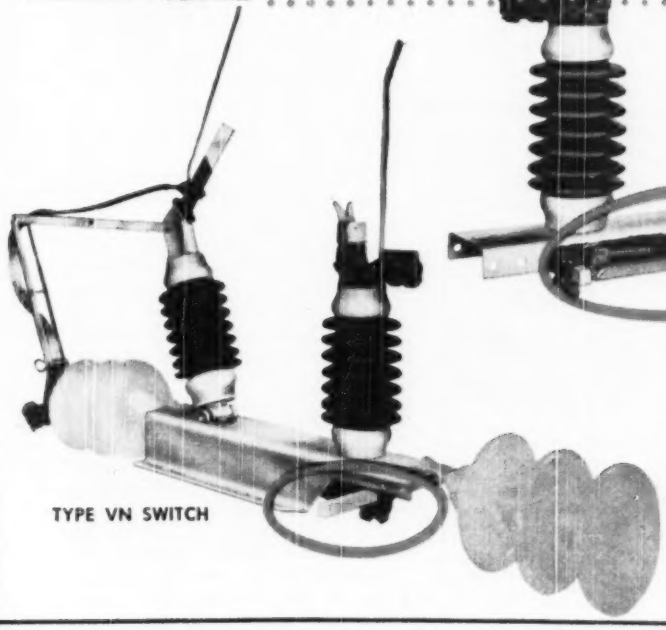
SWITCHES

- New Ease of Installation
- Crow-bar Leverage for Ice
- Compensation for Wood Warpage

Double exposure shows exclusive ice breaking "crow-bar action." Pivot pin is forced up against slot in blade — prying rear of blade up ¾" before contact end is lifted.



TYPE WN SWITCH



TYPE VN SWITCH

COMPENSATOR CONTROL MECHANISM

Cutaway sections of the flanged mounting base show the weather protected Compensator Control that eliminates closing shock and gives *extra leverage* for smooth, easy operation. This mechanism operates each switch unit independently of the others to give positive, uniform blade contact on all phases. Effect of distortion on the control shaft is negligible, as each blade in a three pole switch arrangement makes complete contact without affecting either of the other two blades.

it's RIGHT when you specify CHANCE

A. B. CHANCE COMPANY ABC **CENTRALIA, MO., SAN FRANCISCO, CALIF.**

C50-22

"Automatic" FIRE-FOG protection for large transformer room.

UNINTERRUPTED

POWER SERVICE . . .

an obligation to industry

Uninterrupted service is a cardinal principle in the furnishing of electrical power, an item of essential importance to the user. A transformer fire means more than the loss of electrical equipment and structures. Production losses from out-of-service time are non-replaceable.

Both utility companies and private users have for years been installing fire protection for key facilities. Through the relatively recent development of *Automatic* FIRE-FOG, the safe use of water for the extinguishment of electrical equipment fires, protection of large and small indoor and outdoor electrical installations is now practical from an economic point of view.

Automatic FIRE-FOG is specifically designed for your particular risk . . . electrically safe . . . approved by all leading insurance authorities.

We'll be glad to furnish engineering counsel on *Automatic* FIRE-FOG for your operations upon request . . . *no cost or obligation of course.*

Automatic FIRE-FOG

. . . a famous member of the *Automatic Sprinkler* Family . . . provides basic fire protection for process equipment and storage in the chemical and petroleum industries. On-the-spot protection for quench tanks, dryers, explosive hazards, conveyor openings, air filters, oil filled electrical equipment and other units vital to production line operations.

"AUTOMATIC" SPRINKLER CORP. OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler

FIRST IN FIRE PROTECTION

DEVELOPMENT . ENGINEERING . MANUFACTURE . INSTALLATION

OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

INDUSTRIAL BRIEFS

Induction Heater cuts production costs 30% at the Thompson Products Co, Cleveland, Ohio. Twenty-kw heater hardens approx 35,000 automatic valve tips per day—operating 24 hrs daily with a 5-day week. Since input and time under heat can be exactly controlled, variables encountered with previously used oxyacetylene process have been eliminated. More consistent heating, hardness and hardness depth in treated valves have been obtained.

Glass Counter Top Warming in the travel bureau at Larwill Park Depot of the B. C. Motor Transportation Co, Ltd., Vancouver, B. C. was solved by soil heating cable which was laid flat on an asbestos sheet covering a false bottom in the counter. The heated counters have eliminated chilling effect of glass tops and draft through entrance doors also swelling and cracking of employees' hands. For each square foot of counter top area, 29.6 w was used (400 w per counter). Thermostat controls temperature. Energy consumption per counter with 60 F air temperature is 260 kwhr per mo.

Cold Weather Truck Parking is aided by 100-w immersion heaters connected to motor blocks of the Tidewater Associated Oil Company's auto trucks in middle Atlantic and New England states. Motors start readily because thermostatically controlled heat keeps both water and oil warm. Battery and motor parts life is prolonged. Indoor parking space formerly used for trucks is now used for warehousing products requiring indoor shelter. Heating elements are wired to outlets in fronts or sides of trucks with simple plug receptacles fed by heavy duty extension cord.—L. Albertson, Application Engineer, Philadelphia Electric Co.

Heating and Melting Operations encountered in the metallurgical engineering dept. of Sam Tour & Co, Inc, New York City, are speeded by a 20-kva induction heating and melting unit. Refractory and high melting alloys are melted down with a minimum of contamination. It is also of particular value in heat treatment, case hardening, recrystallization, etc.

For best service where circuits heat up . . .

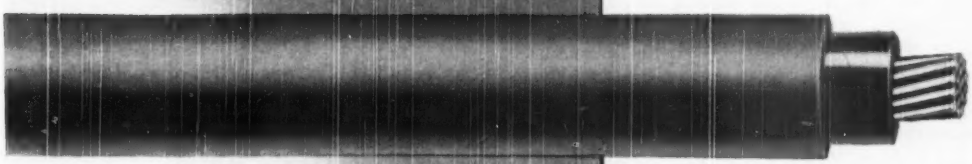
Today it's Roebling!

V. C. Cable that stands the gaff

NEXT TIME YOU NEED new leads for motors, generators, transformers or oil switches, make them Roebling Varnished Cambric Cable! There's nothing better for heat resistance . . . they'll give you brand new dependability . . . save you time and money!

Roebling Varnished Cambric Cable is made in single and multiple conductor types—single, from 2,000,000 C. M. to No. 14 A.W.G.—multiple from 500,000 to No. 14 A.W.G. Both constructions are adapted for use up to 17,000 volts between phases for unshielded multiple conductor . . . up to 21,000 volts between phases for single conductor and shielded cables on ungrounded neutral systems . . . up to 28,000 volts between phases for single conductor and shielded cables on grounded neutral systems.

Write for full information, or call on your Roebling Distributor—he'll be glad to help. John A. Roebling's Sons Company, Trenton 2, New Jersey.



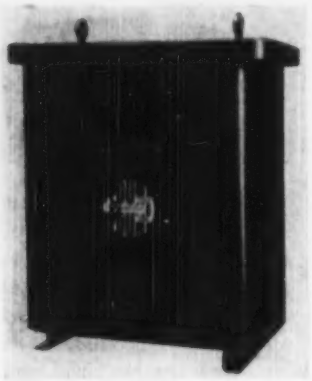
From copper conductors to protective jackets, **Roebling** electrical wires and cables (more than 60 standard types) are made entirely in **Roebling** plants. Engineering and the most modern techniques and precision machines assure *quality* products, unexcelled for service and economy.

ROEBLING

A CENTURY OF CONFIDENCE

Atlanta, 934 Avon Ave. • ***Boston***, 51 Sleeper St. • ***Chicago***, 5525 W. Roosevelt Road • ***Cincinnati***, 3253 Fredonia Ave. • ***Cleveland***, 701 St. Clair Ave., N. E. • ***Denver***, 4801 Jackson St. • ***Houston***, 6216 Navigation Blvd. • ***Los Angeles***, 216 S. Alameda St. • ***New York***, 19 Rector St. • ***Philadelphia***, 12 S. Twelfth St. • ***Portland***, 1032 N. W. 14th Ave. • ***San Francisco***, 1740 Seventeenth St. • ***Seattle***, 900 First Avenue S.

NEW EQUIPMENT



Dry-Type Transformers

Design features of oil-filled distribution transformers have been incorporated in a redesigned line of dry-type transformers. Intended primarily for industrial plants, these transformers serve lighting loads from circuits rated 240, 480, and 600 v.

All sizes have Round Wound construction. Moisture resistant insulating materials are vacuum impregnated with a heat resisting insulating varnish. Sizes from 1½ through 50 kva are wound with Class B insulation, permitting average coil rise of 80 C.

These dry-type transformers are said to be easy to install at practical elevated locations to save floor space. The 1½ through 10-kva sizes are furnished with a bracket for wall mounting. Remaining sizes have lifting lugs on both sides of the tank. Bulletin DT-7 contains further information.

Line Material Co, 800 N. Eighth St, Milwaukee 1, Wis.

•

Induction Motor Starter

Designed for across-the-line starting of squirrel cage induction motors, or as primary switch for wound rotor motors, combination Life-Linestarter, Class 11-206-N, combines motor starter, motor protection, and disconnect in a redesigned enclosure. Aside from the Linestarter, it features AB De-ion circuit breaker, and slamproof self-indicating interlocked handle.

The thermal magnetic circuit breaker makes for delayed tripping of safe overloads, and instantaneous action on short circuits. Designed for use with up to three safety padlocks, the handle is interlocked to prevent opening of the enclosure when breaker is closed.

With capacities from ¼ to 100 hp, and 110 to 600 v polyphase, the unit is available in NEMA sizes 0 through 4, and NEMA type enclosures 1, 1A, 3, 4, 5, 7, and 9.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

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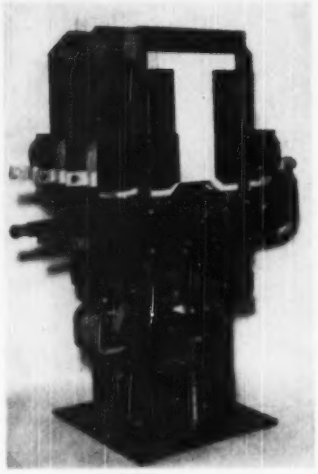
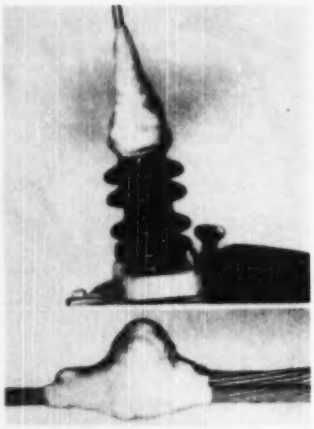


Air Contactor

Ratings of high-voltage air contactor line Type 256 are for general ac motor control applications up to 2,500 hp at 5,000 v or 3,000 hp at unity power factor. The new rating of 25,000 amp for 30 cycles through current makes it possible to use air contactors in conjunction with back-up breakers rated up to 25,000 amp interruption capacity or 150,000 kva at 4,160 v and 100,000 kva at 2,300 v.

Since the new contactor can safely pass 54,000 peak amp, it can be used with non-current limiting fuses rated at 250,000 kva at 4,160 v.

Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.



Insulating Compound

Prevention of corrosion on electrical connections and insulation of live parts for the safety of linemen is reported for Airseal, a pliable, inert compound. By sealing out corrosion and oxidation, the compound eliminates overheating at joints.

Dielectric strength of 280 v per mil makes the compound suitable for covering transformer secondary terminals. The same property makes it suitable for covering primary terminals of transformers and oil circuit reclosers to avoid trouble from birds, squirrels, and other animals.

Manufacturer reports that it can be readily salvaged for re-use. It does not stick to hands or gloves and can be applied in about half the time needed for taping, according to the company. It burns with a slow flame similar to that of electrical tape.

Illustration at top shows the compound applied to a transformer bushing and, bottom, to a connector to prevent corrosion.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

•

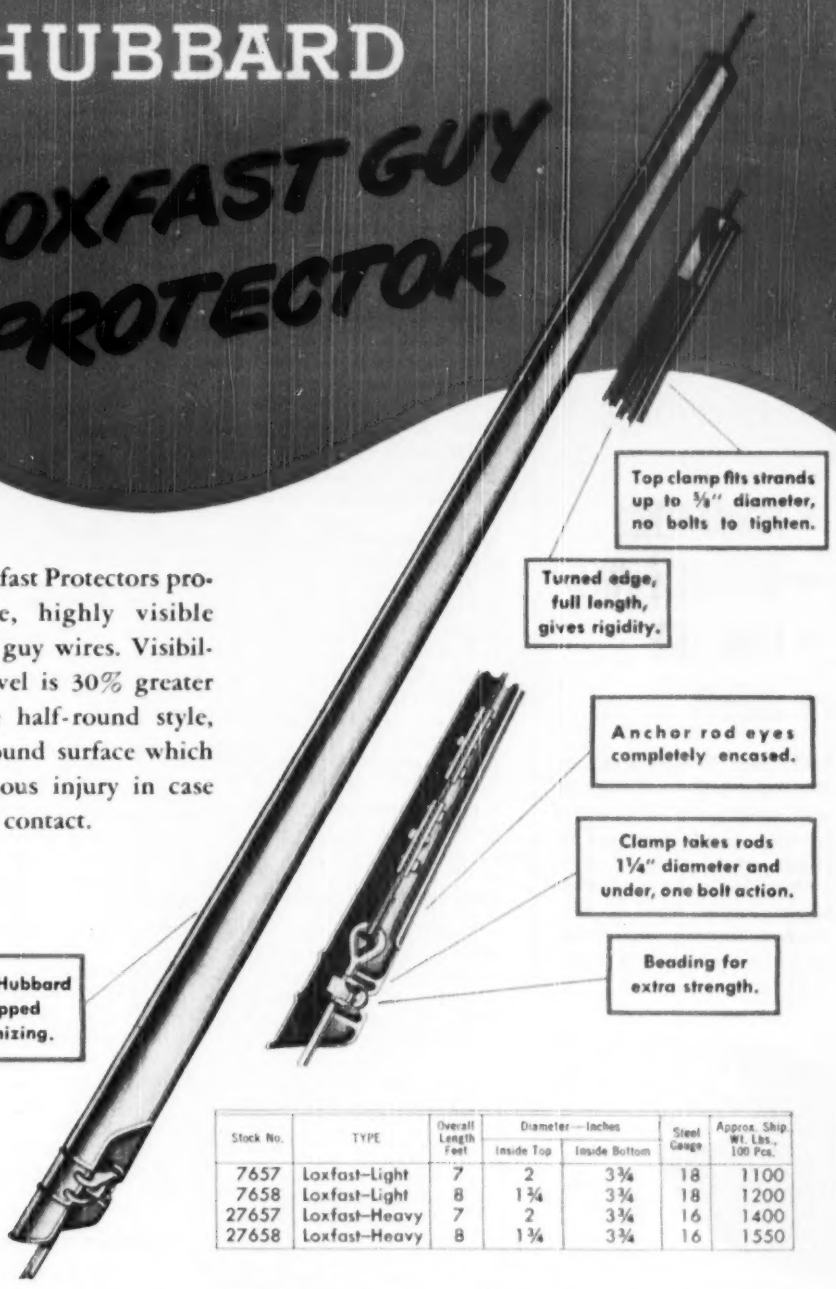
Scale Thickness Indicator

Thickness of scale or other deposits on the inside of boiler tubes, water wall tubes, or other straight or bent tubes or ducts of circular cross sec-

HUBBARD

LOXFAST GUY PROTECTOR

Hubbard Loxfast Protectors provide a large, highly visible covering for guy wires. Visibility at eye level is 30% greater than for the half-round style, plus a full-round surface which prevents serious injury in case of accidental contact.


Top clamp fits strands up to ⅝" diameter, no bolts to tighten.
Turned edge, full length, gives rigidity.
Anchor rod eyes completely encased.
Clamp takes rods 1¼" diameter and under, one bolt action.
Beading for extra strength.
Permanent—Hubbard Double-Dipped Hot Galvanizing.

Stock No.	TYPE	Overall Length Feet	Diameter—Inches		Steel Gauge	Approx. Ship. Wt. Lbs., 100 Pcs.
			Inside Top	Inside Bottom		
7657	Loxfast–Light	7	2	3¾	18	1100
7658	Loxfast–Light	8	1¾	3¾	18	1200
27657	Loxfast–Heavy	7	2	3¾	16	1400
27658	Loxfast–Heavy	8	1¾	3¾	16	1550

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

EVERSTICK ANCHORS...

FIRST CHOICE
for

- PERMANENCE
- HOLDING POWER
- LONG LIFE
- SAFETY

They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron — their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of
"THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

tion is said to be measured to 0.001 in. with a new electrical indicator. Serious damage to the tube may be averted by locating heavy scale deposits, manufacturer asserts.

In making the tests, an electromagnetic probe head is guided through and held against the inside of the tube by guide wheels. The head is fed down the tube with a graduated spring steel tape. The two feet in the probe head bear against the face of the tube and indicate the distance in thousands of an inch between the feet and the metal of the tube. Usual range of the meter is from 0 to 100, in thousandths of an inch.

Pitting or corrosion can also be located with the indicator. When going over rough surfaces—as found in areas of pitting—the meter hand will flicker and read abnormally high.

Standard equipment included are 15 ft of wire and 50 ft of steel tape. It is for use with 110-120 v, 60-cycle supply.

Haskins Turner Co, 1617 Third St, Jackson, Mich.

•

Impregnating Varnish

In addition to being oil-resistant, a new impregnating varnish for electrical units is said not to crack on exposure to −70 F. It is intended primarily for aeronautical and military applications.

Average electrical properties of this ABC varnish are: Dielectric strength (1/16-in. thick), 500 volts per mil; dielectric constant at 60 cycles, 3.3; power factor at 60 cycles, 0.016; loss factor at 60 cycles, 0.05.

Frederick S. Bacon Laboratories, Watertown, Mass.

•

Bail Clamps

Damage to conductors is stated to be prevented by new bail clamps that are permanently installed on the main conductor. The tap-off connection is made to the bail of the clamp with a hot-line clamp or split-bolt connector, preventing burning and pitting of the main conductor when connecting or disconnecting the tap wire. Nicking and scoring of the conductor is also said to be eliminated.

Standard hot-line tools suffice to install the bail clamps having either the eye nut as shown, or a hexagon nut.

There are three sizes for copper conductors: 6 solid min. to 2/0 strand max.; 2/0 solid 4/0 strand; and heavy duty clamp for 2 solid to 4/0 strand. For aluminum conductors, they are plated for 6 ACSR to 2/0 ACSR, 2 ACSR to 4/0 ACSR, and 4 ACSR to 4/0 ACSR.

W. N. Matthews Corp, 3850 Delor St, St. Louis 16, Mo.

•

Combination Starter

Fusible and non-fusible types of a combination starter for the automotive industry are available. It conforms to Joint Industry Conference Electrical Standards for Industrial Equipment.

A drip channel across the top and around the sides of the steel enclosure

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

CURRENT TRANSFORMER
Can be mounted in any position; ratings to 800 amp, 15 kv

CLUSTER LIGHTS
Vertical and horizontal aiming quadrants to aim the light

OSCILLOGRAPH-RECORD CAMERA
Completely developed record without darkroom in one minute

GRATING LOCK
Lock for under-sidewalk utility vault has many features

Look INTO THE POLE STAR

AND SEE WHY IT IS FAST BECOMING A *Best Seller*

Sealed Tank Construction Throughout

All gaskets used in the Pole Star are made of synthetic rubber. A retaining ring in the cover keeps the gasket in its properly compressed position at all times.

No Pockets On The Pole Star

Side-issuing bushings on all Pole Star Transformers, 5000 volts and below, are straight, stud type. This permits the use of lathe-turned bushings on the Pole Star to assure greatest mechanical strength.

Tap Changes Made From Above Oil Level

The tap changer handle is above the oil level, where tap changes can be made with great ease by turning the handle to the proper tap position. White letters on black bakelite clearly show the tap positions.

Shot Blasted— *Then Painted*

Three coats of transformer paint are individually applied and individually baked on to the tank *only after* the surface of the tank is thoroughly shot blasted.

Low Noise Level

The amount of contact pressure between laminations in the Pole Star core is not important because each lamination is actually a core itself. As a result, the noise level in the core is fixed at a low value and will not change.

Low Exciting Current

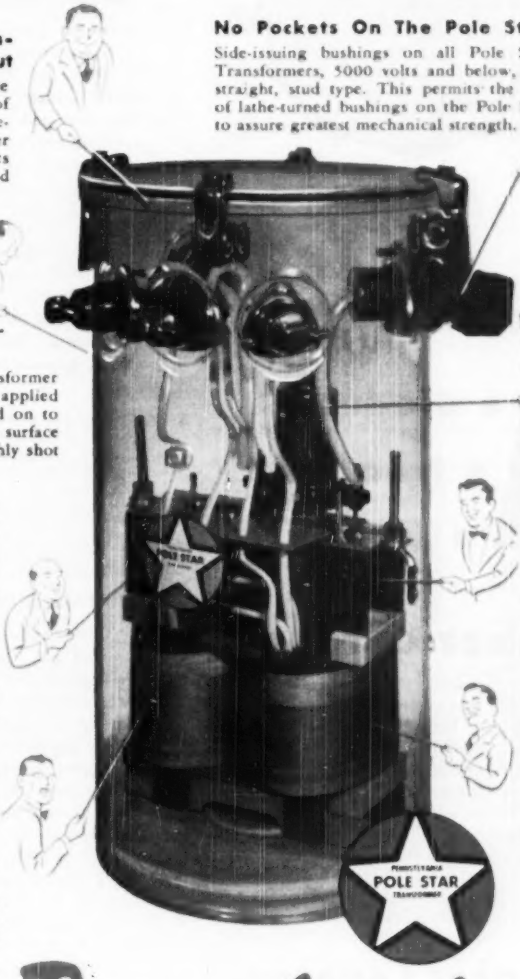
Laminations in the Pole Star core are individually lapped. The large cross section at the lap reduces the density and prevents a concentration of flux. As a result, the reluctance of the magnetic circuit is low. Each lamination forms its own magnetic path undisturbed by butt joints and points of high density.

Core and Coil Units Easily Taken Apart and Rebuilt

If a coil is damaged by lightning or excessive overloading, cores can be taken apart and rebuilt with replacement coils. This can be accomplished without appreciably affecting the low core loss or exciting current of the Pole Star.

Coils Wound Independently of The Core

Separate winding allows each coil to be tightly wound and individually treated to give it great mechanical strength.

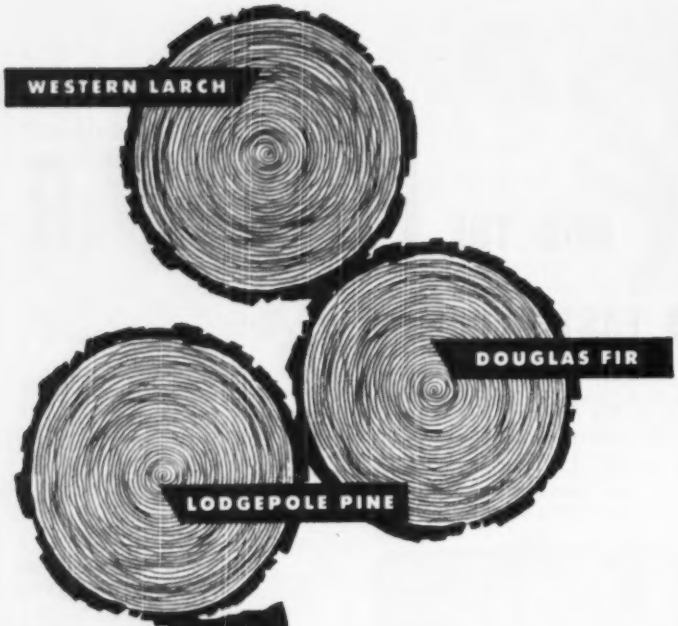


P.S. Let the POLE STAR be your guide . . .

Product Of Long Experience — Safe Thrifty And Reliable

Pennsylvania TRANSFORMER COMPANY

Canonsburg, Pennsylvania — Greater Pittsburgh District



THE Big 3 IN WESTERN POLES

- produced
- treated
- sold by...

J. Neils Lumber Company

Look to the West for transmission and telephone poles... To western Montana, where much of America's finest virgin timber is located...To the J. Neils Lumber Company plant at Libby.

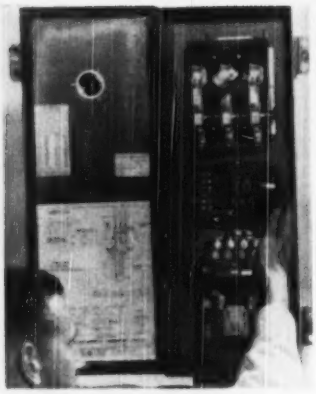
Long a quality manufacturer of forest products (since 1895) J. Neils is a major producer of power and telephone poles.

At Libby, Montana, in the heart of a great forest empire, J. Neils manufactures and treats the poles that come from magnificent stands of Western Larch, Lodgepole Pine and Douglas Fir. This modern pole treating plant measures up to the highest quality standards in men, materials, equipment and methods.

An illustrated folder on J. Neils treated poles, and information regarding their application to your requirements, will be furnished gladly on request.

J N **J. Neils Lumber Company**

Pole Division: LIBBY, MONTANA



prevents liquids spilled on the case from entering around the door. Case contains no knockouts or mounting holes, outside mounting brackets being furnished.

The prescribed machine-tool type transformer, with 230/460-115 v multiple-rated primaries, is included. There is a new ac magnetic contactor with its stronghox coil. The new disconnect switch mounts the fuses on the front, and when the door is opened, there is visible indication that the switch is in Off position.

General Electr'c Co, Apparatus Dept, Schenectady 5, N. Y.

•

Volt-Ammeter Accessories

Two accessories have been developed for the Amprobe snap-on volt-ammeter. First is the 10x Sensitizer, said to make possible easier low-current readings. When plugged between equipment being checked and the outlet, it multiplies the sensitivity of the Amprobe by 10 times. It adds three low-current ranges to the Amprobe, and is useful when checking motors of ¼ hp and under. Capacity is 10 amp intermittent, 2.5 amp continuous.

The Split Plug is of similar construction except that it has no windings. It facilitates snap-on current readings of equipment having sealed double-conductor electric cord. When plugged in between equipment being

(*Continued on page* 156)

This Tap Changer Story began

20 YEARS ago . . .

Straight Line FACTS

Purchasers of transformers are extremely interested in tap changer design because the failure of a tap changer can cause the failure of a transformer.

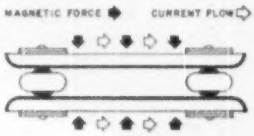
Twenty years ago Pennsylvaina Transformer Company developed the Straight-Line Tap Changer and began using it in all Power Transformers. Succeeding years brought modifications and improvements but, in essence, the present Straight-Line Tap Changer is the same as the one introduced in 1930.

For twenty years the Straight-Line Tap Changer has functioned in all types of Power Transformers under all operating conditions.

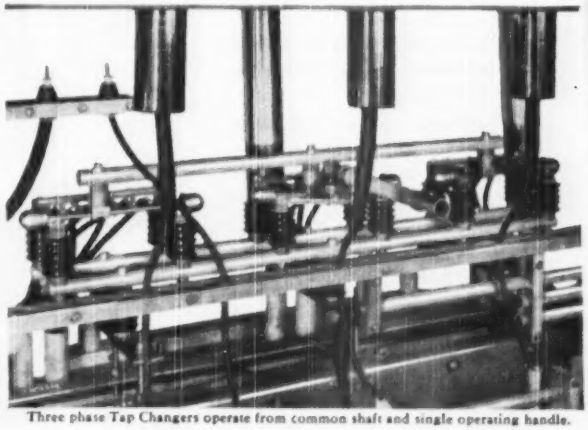
Not once in all this time has there been any reason to question the fundamental principles of the Straight-Line design.

The performance record of the Straight-Line Tap Changer is adding to the reputation of Pennsylvania Transformers. It is one of the reasons for the confidence put in Pennsylvania by a growing number of leading Utilities that are placing important orders for Pennsylvania Transformers.

- Flexible steel spring construction and straight line motion of movable jaw assures a self-aligning, high pressure contact at all times.
- All contacts made of a time-tested silver-nickel mixture which possesses the electrical qualities of silver but is inert to chemical reactions. Contacts are pressure and temperature treated for high conductivity and high resistance to wear.
- Contacts are self-cleaning. Each operation of tap changer results in a positive wiping action.
- Straight Line Tap Changer withstands dead short circuits. Design of Tap Changer is such that magnetic forces cause moving contacts to increase pressure during short circuits. There is no blow-off action.

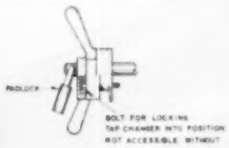


- Transformer cable leads crimped to ends of stationary jaws. Crimping provides a high quality mechanical and electrical connection without possibility of crystallization due to brazing.
- Tap Changer located in top section of tank — above core and coils — where it is accessible through handholes or manholes for simplified inspection and maintenance.



Three phase Tap Changers operate from common shaft and single operating handle.

Operating handle issues through side of case and is provided with a positive locking mechanism.



Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNA. • Greater Pittsburgh District

With rare exceptions on commercial and industrial installations

Ordinary Fuses and Breakers Do Not Protect Except Against Short-Circuits But—

Fusetron DUAL-ELEMENT Fuses Provide 10 Point Protection

What is the FUSETRON Dual-Element FUSE?

A fuse link combined with a thermal cutout — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, FUSETRON Fuses fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Count 'em

1* **Protect against short-circuits.**

2 **Protect against needless blows caused by harmless overloads.**

3 **Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.**

4 **Provide thermal protection — for panels and switches against damage from heating due to poor contact.**

5 **Protect motors against burnout from overloading.**

6 **Protect motors against burnout due to single phasing.**

7 **Give DOUBLE burnout protection to large motors — without extra cost.**

8 **Make protection of small motors simple and inexpensive.**

9 **Protect against waste of space and money — permit use of proper size switches and panels.**

10 **Protect coils, transformers and solenoids against burnout.**

* Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

DON'T RISK LOSSES

One **needless** shutdown — one **lost** motor — one **destroyed** switch or panel — one **burned out** solenoid — may cost you **far more** than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Mail the coupon now for complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name_____

Title_____

Company_____

Address_____

City_____ State_____ 1250

GUTH LITE-BLOX

RECESSED TROFFERS because . . .

You can create with them an endless variety of efficient and aesthetic lighting patterns. It's simple: LITE-BLOX take the place of ceiling blocks.

- FAR MORE VERSATILE—18 sizes all with same cross-section. 32 choices of standard and slimline fluorescent lamps. Wide range of diffusing and shielding media.
- FAR EASIER, CHEAPER TO INSTALL— One-man can hang them with QM Brackets. Complete units ready to mount—no joiners. Exact footlengths—no trimming.
- PLUS THAT "HAND-CRAFTED" LOOK—Snap-on tailored trim in choice of smart plated finishes gives costly "custom-made" appearance

—at stock prices!

Build Your Relighting Plans With LITE-BLOX

For full details call your nearest GUTH resident engineer or write today for Bulletin 869-H.

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting Since 1902

New Equipment

(Continued from page 152)

checked and the outlet, it separates conductors without touching the wire. Capacity is 30 amp intermittent, 15 amp continuous.

Pyramid Instrument Corp, 49 Howard St, New York 13, N. Y.

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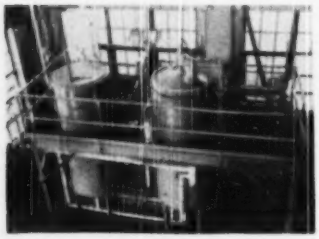

Impregnation Equipment

Impregnation of electrical coils, carbon parts, wood, and a variety of other materials, can be accomplished with a new line of equipment. It provides a quick-opening vacuum and pressure closure, allowing the tank cover to be opened or closed in seconds without manual effort.

The equipment is available in a complete range of sizes for vacuum and pressure operation, and for use by heating with steam, electricity or Dowtherm, or for non-heated operations. Complete units or principal parts only can be furnished. Complete details are in Bulletin B-30.

Illustrated is a unit used for impregnating carbon electrodes with a binder.

Struthers Wells, Corp, Warren, Pa.

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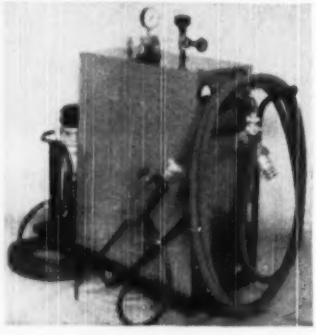

Steam-Jet Cleaner

Machinery, lighting facilities and washrooms are said to be cleaned safely and silently in a crowded fac-

tory with the JC-20 Speedyelectric boiler. The boiler water itself is the electric resistance heating element. If there is no water, no current passes and no steam is generated. Rated at 20 kw maximum, 220, 440, or 550 v, the JC-20 under ordinary operating conditions consumes 15 kw.

Solvents are applied instantly as needed by pushbutton control. This portable unit is 16 in. wide and 40 in. long.

Livingstone Engineering Co, 100 Grove St, Worcester 5, Mass.

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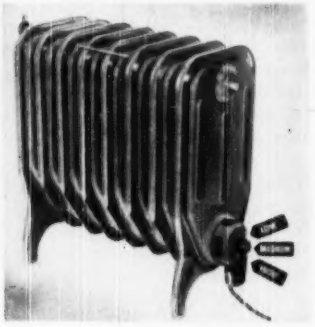


Electric Steam Radiator

Three-heat adjustable control is a feature of a portable electric steam radiator. The 900-w heating element is encased in a copper tube. Model AS8, illustrated, has a radiating surface of 20 sq ft and a capacity of two quarts of water.

Smith-Benny Sales Co, Inc, 11 W. 42nd St, New York 18, N. Y.

MORE NEW PRODUCTS
about which you should know

Radio Corporation of America, Camden, N. J., offers a 70-w and 250-w Fleetfone **transmitter and receiver** for fixed-station use in metropolitan systems, or rural applications demanding coverage of extensive areas. . . . RCA also has available a new system for remote **control of microwave** parabolic antennas in the field at distances up to 1,500 ft. The parabola is driven with 1/6-hp motors.

Blackhawk Industries, Dubuque, Ia., has non-watertight **connectors**, No. 410 and 411, with steel locknut

Dependable FIRE PROTECTION...

STARTS WITH ANSUL water-tight CONSTRUCTION

CUTAWAY VIEW, ANSUL MODEL 20-B

The new, improved Ansul Model "B" Extinguishers have the greatest fire-killing ratings* ever attained by hand portable fire extinguishers. In addition, WATER-TIGHT CONSTRUCTION, (exclusive with ANSUL) has resulted in far greater dependability than any other dry chemical extinguisher.

In fire protection equipment, the best is none too good. Accordingly, Ansul engineers conduct continuing research for improving Ansul Extinguishers and Dry Chemical. Ansul Quality has set a high standard for newcomers in the dry chemical fire extinguisher field. This unparalleled standard of quality is constantly being raised by Ansul research and development.

Exclusive Features

- Patented Nozzle assures most effective stream pattern . . . Best results by inexperienced operators.
- Special packings in Nozzle and other parts exclude water.
- Corrosion resistant construction throughout.
- Easy on-the-spot Recharging (No tools needed).
- Quick, *positive* puncture operation.
- Special cartridge gauge prevents cartridge . . . rugged construction throughout.
- Ansul "PLUS-FIFTY" Dry Chemical used exclusively.
- Field tested by thousands of satisfied customers.

Send for File No. 609. You will receive a variety of helpful printed matter. Included is our latest catalog which describes Ansul Extinguishers of all sizes — from the small Ansul Model 4 to Ansul Piped Systems and Ansul 2000 lb. Stationary Units.

*Factory Mutual Laboratory Reports of Examinations and Tests.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION
MARINETTE • WISCONSIN

DISTRIBUTORS IN ALL PRINCIPAL CITIES IN THE U. S. A., CANADA AND OTHER COUNTRIES

THIS TRADE MARK ASSURES YOU OF QUALITY PRODUCTS

Thanks to a FAST-ACTING

BLAW-KNOX FOG SYSTEM

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

Actuated by sensitive rate-of-rise thermostats, Blaw-Knox Fog Nozzles go into action with the speed of electricity . . . sending a heavy, quenching fog to the danger spot, extinguishing the fire and protecting adjacent transformers. Blaw-Knox Fog Nozzles have no screens to clog, do not require treated water and maintain their effective spray pattern even at reduced pressures.

At your request a Blaw-Knox Engineer will make a survey of your fire hazards, prepare a preliminary layout that will give you the utmost in fire protection and submit an estimate of costs—all without obligation.

Blaw-Knox Fire Protection Systems carry the approval of all insurance underwriters.

BLAW-KNOX SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
829 Beaver Ave., N.S., Pittsburgh 12, Pa.
Offices in Principal Cities

BLAW-KNOX FIRE PROTECTION SYSTEMS

and steel cable clamps, for use with service entrance cable and larger size non-metallic sheathed cable. . . . The Still-Man Co, 429 E. 164th St, New York 56, N. Y., is making sheathed electrical **heating elements** for industrial applications and for irons and waffle irons, grills, etc; sheath diameters from 0.28 to 0.50 in. Also added were immersion heating elements for water, oil, and air.

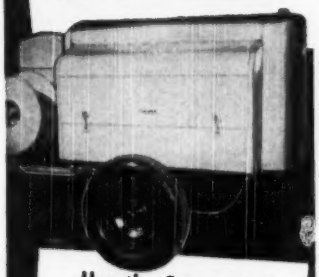
Aget-Detroit Co, Ann Arbor, Mich., is producing a 10,050-cfm **dust collector** for separating industrial dusts from the air stream. Motor is 15 hp, 3-ph, 220 or 440 v, 60-c. . . . J. H. Williams & Co, 400 Vulcan St, Buffalo 7, N. Y., is marketing **reversible tongs** that will turn pipe in either direction without removing the tongs or loosening the chain; four sizes from ¼ in. to 8 in.

The W. L. Maxson Corp, Unimax Switch Div, 460 W. 34th St, New York 1, N. Y., has designed Type MXR Unimax **switch** to be built into machine tools or other apparatus where electric control is to be initiated by movement of a cam or dog. . . . M. E. Cunningham Co, 125 E. Carson St, Pittsburgh 19, Pa., has Model JG-1 **stamping tool** for stamping steel sheet, strip and other flat thin metals.

General Electric Co, Schenectady 5, N. Y., has announced a **fan kit** that may be built into kitchens, poultry houses, dairy barns, etc. Can be assembled in 10 minutes for use on 115 v, 60 c. . . . G. E. Co Commercial Equipment Div, Electronics Park, Syracuse 3, N. Y., also has a new 50-w **mobile radio** combination No. 204 for the 148-174 mc band.

Eriez Mfg Co, Erie, Pa., is making a pressure-tight non-electric **magnetic separator** to remove stray iron from liquids, slurries, and slips flowing in pipelines that vary in diameter from 6 to 20 in. It prevents ramp iron damage to pumps, grinders, etc. . . . Industrial Electronics & Transformer Co, 8655 S. Main St, Los Angeles 3, Cal., has designed a **temperature control** for hot dimpling of aluminum alloys and associated processes for metal fabricating and aircraft industries. Units are available for use with portable or stationary dimplers in sizes from 100 w to 100 kw.

Bring Compressor Costs Down!



Use the Economical

SMITH 105-P Compressor

The new Smith 105-P will handle the majority of your compressor jobs, for less. Powered with Chrysler's newest and largest Industrial engine—Ind. 15, six cylinders, 4" bore, 5" stroke, 377 cu. in., 2" crankshaft, 7 main bearings, sodium cooled valves and Stellite valve seats for extra heavy duty and long life. Compressor valves are stainless steel disc type with Manganese Bronze seats. Delivers 105 cubic feet per minute. Equipped with improved type pilot valve and simplified control for efficient, long life with minimum attention.

Write for literature and prices.

Also write for information on
The New SMITH
MODEL 70-P COMPRESSOR

SMITH
Air Compressors

Gordon Smith & Co. Bowling Green, Ky.
482 COLLEGE STREET

"Your suggestion, Mr. Abernathy, that we buy only **KOPPERS POLES** has made you 'the year's most valuable employee'!"

Everybody reaps rewards when Koppers Poles are used!

Line Supervisors get poles that retain their strength, and reduce maintenance work. Deliveries are made when promised, too. The result is easier, more economical line operation.

Purchasing Agents like to deal with Koppers. All transactions are on a businesslike basis. Plus the fact that deliveries are dependable and the quality of the poles is uniform.

Company Officials find that Koppers Poles provide longer periods of *continuous* service, thus increasing revenue and promoting customer good will. And the exceptionally long pole life lowers annual operating costs.

Let us quote on your next requirements. From one of our many treating plants, we can deliver Koppers Full-Length Pressure-Creosoted Poles.

KOPPERS COMPANY, INC. PITTSBURGH 19, PA.

KOPPERS **PRESSURE-TREATED WOOD**

NEWS ABOUT PEOPLE

Kilpatrick Is Sales VP for Leader Electric Co

J. L. Kilpatrick, in charge of sales for the Eastern division of Leader Electric Co, has been named vice president in charge of development

Affiliated Photo—Conway

J. L. KILPATRICK

and sales promotion. He will continue to maintain offices in New York City.

Before going to Leader Kilpatrick was vice president of Silvray Lighting, Inc. He also spent a number of years with Westinghouse Electric Corp. During the last year he investigated lighting developments in Germany for the U. S. government.

Kilpatrick has served on many committees of the Illuminating Engineering Society, and is a member of the U. S. national committee of the International Commission on Illumination.

•

A. K. Mann, power procurement officer for the Corps of Engineers, has been named director of the utilities division of the public works department of the 12th Naval District with headquarters in San Francisco. He succeeds **O. O. Rands,** who resigned to become assistant power director for the Bureau of Reclamation at Sacramento. Mann was with General Electric Co and Central Hudson Gas & Electric Corp before becoming an engineer for the Federal Power Commission in 1934. During the war he was priority engineer, utilities division, War Production Board.

Charles H. Jennings, engineering manager of the welding department of Westinghouse Electric Corp, has been elected first vice president of the American Welding Society.

•

W. T. Lucking Advanced by Arizona Edison Co

Walter T. Lucking, assistant to the president of Arizona Edison Co, has

WALTER T. LUCKING

been elected a vice president. He will be in charge of departments handling personnel, contract negotiations, rates, new business, safety, advertising, and publicity.

Lucking joined Arizona Edison May 1. He went there from Ohio Public Service Co (now merged with Ohio Edison Co), where he had been for eight years. His most recent assignment in Ohio was that of project manager in a $34-million construction program. Earlier he served Cities Service Co, parent of OPS.

•

Harry G. McDavitt, Jr, has been appointed advertising manager of Apex Electrical Manufacturing Co, Cleveland. Before joining Apex in 1948 he was with Palm & Patterson Advertising Agency and Brown Fence & Wire Co.

New Mexico PS Makes Reeves Vice President

R. W. Reeves, former general sales manager of Oklahoma Natural Gas Co, has been appointed executive vice president of Public Service Co of New

R. W. REEVES

Mexico. In the newly created position he will be responsible for all phases of the company's operations.

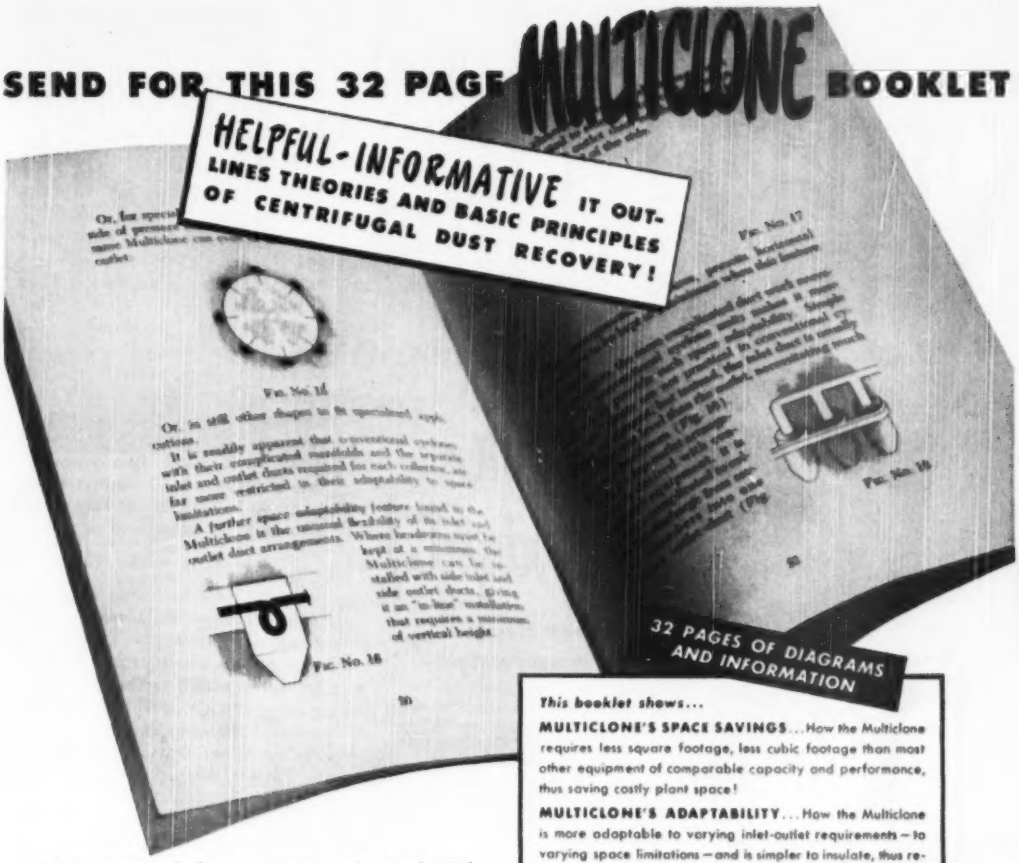
Reeves started in the utility industry as an engineer for Louisiana Electric Co and its successor, Gulf States Utilities Co. He joined Oklahoma Natural Gas in 1938 and returned to it in 1946 after military service. He was sales manager for four years.

•

Bertram V. Jones has been appointed advertising manager of Link-Belt Co to succeed Julius S. Holl, who died recently. He joined the company's advertising department in 1923 and has been executive assistant advertising manager since July. **John F. Kelly** will continue as assistant advertising manager.

Don H. Hamilton, superintendent of electric utilities at Jetmore, Kan., has been elected president of the Kansas Association of Municipal Utilities. He succeeds **Ralph J. Duvall,** manager of the production and distribution board of public utilities, Kansas City, Kan. New vice presidents are Major C. Hagar, superintendent of the water department, Lawrence, and Fred D.

SEND FOR THIS 32 PAGE MULTICLONE BOOKLET


HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
Fig. No. 16
Fig. No. 17
Fig. No. 18
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

NOW SELLING...

COTTRELL Precipitators
MULTICLONE Collectors
TURBULAIRE Spray Dryers

...in all parts of the U. S. A. and foreign countries.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

Treat your poles right!
Protect them with clean, certain Penta Preservative
Penta-protected poles and cross arms are clean! You'll have lots of praise—and no complaints—from line crews and customers when you specify clean Penta Preservative treatment.
You can absolutely depend on Penta for protection from insect attack and decay. Even after years of service, you'll find no ground line decay, shell rot, top rot, or insect damage in Penta-treated poles and cross-arms.
That's because PENTAcholorophenol is a powerful, stable and uniform wood preservative—allows measured and positive protection. It's always the same! Penetrates deeply into the wood and will not leach out. Doesn't affect conductivity, creates no special problems.
Specify PENTA treatment for safeguarding your poles, cross-arms and other wood construction. It costs no more than other types of preservation. Write us for complete facts and names of companies supplying Penta-treated products.
CHAPMAN CHEMICAL COMPANY
333 N. Michigan Ave. • Chicago 1, Illinois
Dermon Building • Memphis 3, Tenn.
CHAPMAN
Penta Preservative
Conforming to A. W. P. A. Specifications P8-49 and P9-49.

Diehl, superintendent of water and electricity, McPherson.

•

GE Promotes Lauder, Makes Other Staff Shifts

Arthur H. Lauder has been appointed manager of engineering of General Electric Co's Large Motor and Generator Divisions at Schenectady, N. Y. He succeeds the late Earle S. Henningsen.

Several other appointments also have been reported by GE. James A. St. Louis is the new manager of the Cuyahoga Lamp Works at Nela Park, Cleveland. Roger Rollett has been appointed superintendent of the Somersworth, N. H., plant. In a reorganization of the Small and Medium Motor Divisions J. T. Farrell has been named assistant to the manager of sales.

A. H. Lauder

Lauder went to GE in 1922 as a student engineer. He joined the Large Motor and Generator Divisions in 1923 and remained until 1945 when he was appointed to the staff of the manager of GE's Schenectady Works. After returning to the Large Motor and Generator Divisions in 1947 he was named assistant manager a year later.

St. Louis succeeds Percy J. Johnson, who died Nov. 1. With GE since 1929, St. Louis was at the Hoboken Works before being transferred to Nela Park in 1939. Since then he has been manufacturing engineer at Cuyahoga. Rollett has been with the company since 1936 when he was made an apprentice at Pittsfield, Mass.

Divisions Reorganized

Farrell will supervise the marketing and promotion division and a newly created gear-motor and packaged drive sales division. Manager of the new division will be Howard Bennett. Another new group, the Erie (Pa.) dc armored motor sales division will be headed by Paul D. Ross. The former gear-motor sales division and dc motor sales division have been dissolved. The new gear-motor and packaged drive sales division will be responsible for sale of gear-motors, mechanical drives sold with motors, and packaged drives, and the new Erie division will handle dc armored motors. Products of the discontinued dc motor sales division not specifically

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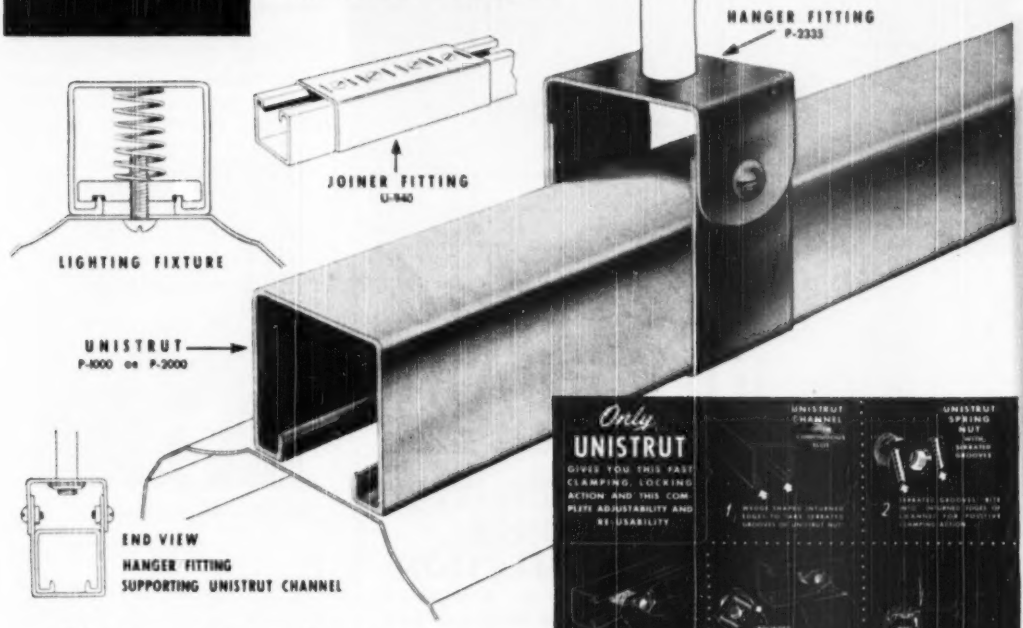

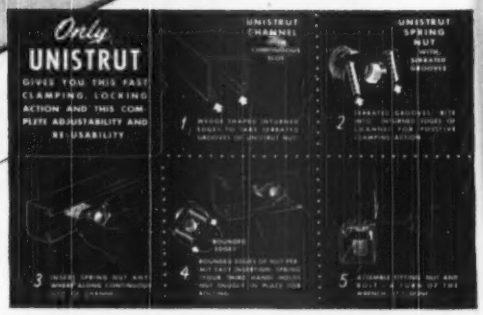
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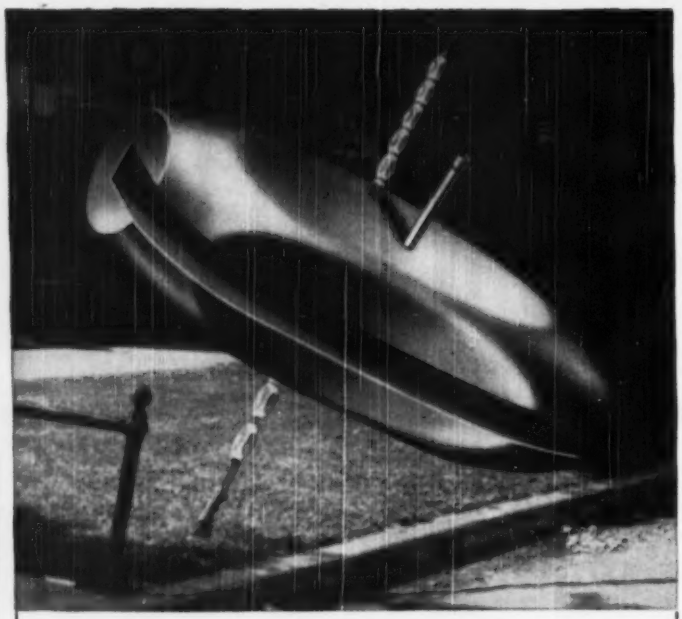

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(the aluminum-coated wood guard that's flexible)

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Approved by R.E.A.

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assigned to either of the new organizations will be transferred to the Lynn (Mass.) motor sales division.

•

James W. Greenbowe, former manager of the Bloomfield (N. J.) Patent Division of Westinghouse Electric Corp. has retired. He has been consulting patent attorney to the division since last May when William F. Kelly succeeded him as manager. Greenbowe was patent counsel for Babcock & Wilcox in Bayonne before joining Westinghouse's patent staff in 1920.

OBITUARY

William McClellan

Dr William McClellan, 78, former president and chairman of the board of Union Electric Co of Missouri,

DR WILLIAM McCLELLAN

died Nov 14 at his home in Alexandria, Va.

McClellan retired from Union Electric in 1946. He served as its president from 1939 to 1941, when he was made chairman of the board of directors. Before going to Union Electric he was president of Potomac Electric Power Co.

From 1900 to 1905 McClellan taught physics at the University of Pennsylvania. Later he was an engineer with Westinghouse, Church, Kerr & Co; a director of Campion-McClellan Co; a member of Paine, McClellan & Campion and McClellan & Junkersfield, engineering firms, and a consulting engineer for the New York Public Service Commission. McClellan & Junkersfield erected the Cahokia power plaat for Union Electric near East St. Louis, Ill.

McClellan also had been a vice president of Stone & Webster Engineering Corp and of Cleveland Electric Illuminating Co and dean of the Wharton School of Finance at the University of Pennsylvania. He was a past president of the American Institute of Electrical Engineers and in 1925 served on the President's Committee on Muscle Shoals.

•

Stuart B. White, 58, member of the Michigan Public Service Commission, was killed recently in an automobile accident. He had been on the PSC since 1947. His present term would have expired in 1953. A Republican, he had figured in a number of clashes with Gov G. Mennen Williams, a Democrat, over increases in utility rates. Before joining the commission White practiced law and held various elective offices in Niles.

Charles Henry Woolley, 44, assistant manager of the proposition department of Babcock & Wilcox Co, New York, died recently in Cranford, N. J. He started with B&W in 1927 as an apprentice engineer and invented a number of improvements in steam generator construction and operation. He was particularly active in development of boilers and related equipment.

A. O. Meyer, 71, manager of Duke Power Co at Hendersonville, N. C., until his retirement in 1942, died there Nov 20. In 1903 he worked on Catawba Power Co's first dam near Charlotte. He went to Hendersonville in 1917 to help build the Lake Summit and Turner Shoals Dams.

Frederick W. Hotchkiss, 55, secretary-treasurer of Electric Machinery Manufacturing Co, died recently in Minneapolis. Hotchkiss joined the company in 1918 and spent 12 years in the engineering and headquarters sales department before being made treasurer and later secretary.

Joseph T. Foster, 60, vice president of Public Service Electric & Gas Co, Newark, N. J., in charge of real estate and purchases, died Nov 21. He joined Public Service in 1913 and was made a vice president in 1927.

Richard A. Whitney, 58, general planning engineer for Public Service Co of Northern Illinois, died recently in Houston, Texas. He had been with the company 37 years.

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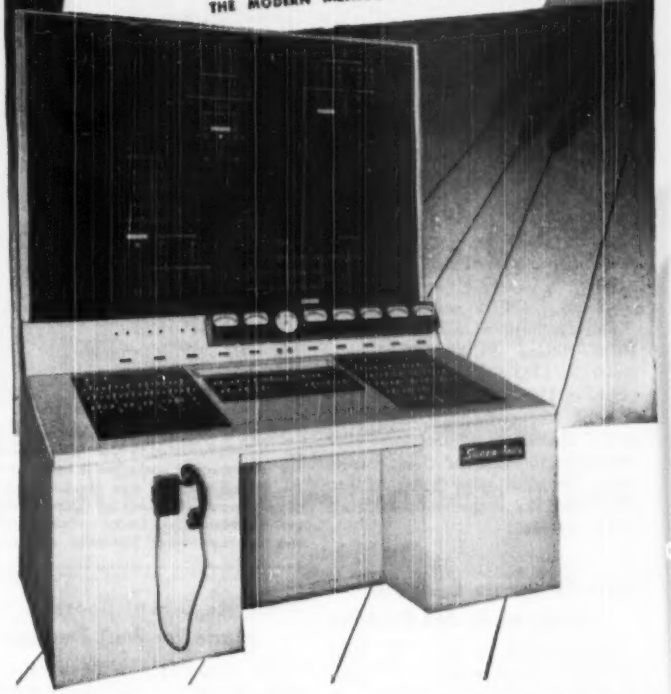

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PROVIDES FAST FINGERTIP CONTROL

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A visual aid showing location as well as operation of equipment. Very valuable in an emergency.

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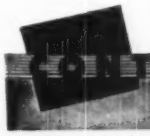

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MANUFACTURERS and MARKETS

GE Profits, Sales Set Record in First 9 Months

Record levels of consolidated sales and net earnings for the first nine months of 1950 are reported by General Electric Co.

Net sales billed totaled $1,354,483,215, or 14% more than in the first nine months of 1949, and net earnings amounted to $112,919,454, a 67% increase over the $67,612,879 earned in the corresponding period a year ago. These earnings were equivalent to 8.4¢ and 5.7¢, respectively, on each dollar of sales and to $3.91 and $2.34, respectively, per share of common stock.

During the third quarter net sales billed totaled $473,432,973, compared to $388,615,888 in the same period of 1949, and net earnings $35,474,462, compared to $21,060,037 last year. Third quarter earnings were equivalent to 7.5¢ and 5.4¢, respectively, on each sales dollar and to $1.23 and 73¢, respectively, on each common share.

•

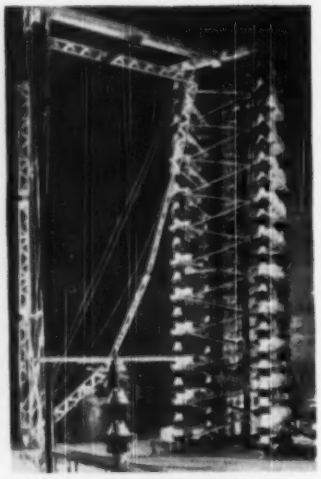
Allis-Chalmers Earnings Doubled in 3rd Quarter

Third-quarter earnings of Allis-Chalmers Manufacturing Co were more than double those for the corresponding period a year ago.

Net profits for the quarter amounted to $7,322,346, or $2.79 a common share, 103% above the $3,616,230, or $1.32 a share, reported for the third quarter of 1949. Nine-month earnings in 1950 were 31% above 1949, $17,613,821, or $6.65 a common share compared to $13,493,658 or $5.02 a share last year.

Billings for the third quarter were 13% greater than in the 1949 quarter, but for the first nine months of this year they were down 7%. Third-quarter billings amounted to $90,473,070, compared to $80,181,711 a year earlier; for the nine months they were $252,155,743 this year and $270,454,453 last year.

Bookings for the third quarter and nine months of 1950 were $105,679,447 and $264,321,789, respectively.



THREE-MILLION-VOLT impulse generator recently installed in high-voltage testing laboratory of Locke Inc is being used for design tests on new insulators and routine production checks. Corner supporting columns are Locke switch insulators not customary Herkolite cylinders

Tin Price Down; Boosts Made for Mill Products

The rampaging price of tin settled down a little in the week ended Nov. 27. On that date the metal was being offered in New York at $1.25 a lb, compared to its high earlier in the month of $1.70.

Carnegie-Illinois Steel Corp announced that its prices for the year 1951 on tin mill products would reflect an average increase of approximately 12%. Meanwhile the World Tin Conference, called at Geneva in an effort to stop the runaway price spiral and ensure equitable distribution to nonproducing countries, collapsed. Principal cause of the current race to buy tin, which has driven the price from its World War II level of about 52¢ a lb, is believed to be the threat of invasion of Far Eastern tin source lands by Communist China.

Despite efforts of producers to hold the price line, prices of most other metals are zooming in the gray market. Zinc, officially 17½ ¢, is changing hands at 25-40¢. Copper, being sold by producers at 24½ ¢, is priced in outside markets at from 30¢ to 40¢ a lb. Copper is expected to be next on the National Production Authority's cutback list, following aluminum, steel, and zinc.

Metal Prices
Nov 27, 1950

COPPER, Conn. Y., lb	$ 24½
LEAD, N. Y., lb	17
ZINC, prime Western, E. St. Louis, lb	17½
TIN, Straits qual, N. Y., lb	1.25
ALUMINUM, ingot, base price	.19
NICKEL, base price	.68
STEEL, billets, Pitts., ton	53.00
STEEL, scrap, No. 1 heavy, Pitts., ton	44.00

•

Reynolds Agrees to Build Aluminum Plant for GSA

Reynolds Metals Co will build an aluminum plant with annual production of 75,000 tons under an agreement reached with the General Services Administration. Operation is expected to begin in the first half of 1952. Site of the plant has not yet been decided.

In the agreement with GSA Reynolds promises a total of 179,000 tons of aluminum annually for stockpiling. Among arrangements already made is a plan for expansion at the Jones Mill, Ark., plant by 25,000 tons annually. GSA will buy the aluminum produced by the expanded facilities and help the company get accelerated amortization and guaranteed loans, if needed, under the Defense Production Act. Negotiations are under way with other companies for new plants and expansion of existing ones.

MANUFACTURING BRIEFS

Wage increases averaging slightly more than 10¢ an hour will be given some 1,900 production and maintenance employees of Western Electric Co's Allentown, Pa., electronics plant. The agreement supplements the initial contract between the company

International L-120 (GVW 5,400 pounds) with a new, special-design service body. Body features include: built-in trays and weather-tight compartments; doors with slam-action catches and cylinder locks all keyed alike; and extra-safe rolled edges on shelves and partitions.

This light-duty International helps take the tension out of high-tension work

Even when service work keeps your men working at top speed, you can count on light-duty International Trucks to lessen the strain.

You can count on the $11,000,000 valve-in-head Silver Diamond engine to deliver more power for faster trips to and from jobs. You can count on Super-steering and Super-maneuverability for new ease of handling, faster threading through traffic, and quicker turns in the shortest practical circles. Most important . . .

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Heavy-duty engineered stamina means day-in-and-day-out dependability, no matter how tough the going might be.

You get extra strength in every part of every light-duty International. This assures you the savings in operation and maintenance and the long life that have kept Internationals first in heavy-duty sales for 18 years.

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A service man rides in an International Truck in almost as much comfort as he rides in a passenger car.

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and the International Brotherhood of Electrical Workers, AFL, which became effective Apr 21. Only wage scales were changed. The agreement will run 18 months with no reopening provision.

Kaiser Aluminum & Steel Corp has speeded up construction at its Spokane, Wash., plant in an effort to increase the unit's future primary aluminum pig production by some 16%. A new reduction line, to be completed in January, will boost production capacity by more than 3 million lb a month.

Kuhlman Electric Co, Bay City, Mich., soon will start furnishing Perma-Kuhl, a new inhibited oil, with all its distribution and power transformers (see EW, Oct 30, p 13, for similar action by other manufacturers).

Jamaica Bauxites Ltd, wholly owned subsidiary of Aluminum, Ltd, Montreal, will begin construction of its $8-million alumina plant in Jamaica, British West Indies, as soon as materials and equipment can be obtained. Aluminum will advance $1.5 million and the rest of the cost will be met through a loan from the Economic Cooperation Adminstration. Capacity will be 100 tons of alumina a day and could be expanded tenfold with an additional investment of up to $30 million if conditions warrant.

Westinghouse Electric Corp will add a 100,000-sq-ft wing to its lamp plant in Little Rock, Ark. Expansion of the floor space by two-thirds will make possible production of household-type light bulbs in Little Rock rivaling that at Westinghouse's Trenton, N. J., plant. Ralph C. Stuart, vice president, said. Sun lamps, heat lamps, and mercury vapor lamps also are made at the Arkansas plant.

An interim order cutting back civilian use of cobalt by 70% has been issued by the National Production Authority. Cobalt, important ingredient in steel, is a key substance in the manufacture of magnets for television and radio sets. The action will cut radio and television production about 50% during the first quarter of 1951 unless relief is given the industries, A. D. Plamondon, Jr. president of Indiana Steel Products Co, Chicago manufacturer of cobalt permanent magnets for electronic devices, predicted.

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PALNUT Self-Locking Nuts are inexpensive single thread, tempered spring steel lock nuts — easily, speedily spun on top of regular nuts with the fingers, locked tight with a wrench.

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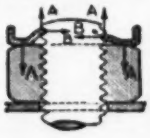
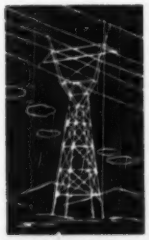
Arched, slotted jaws grip the bolt like a chuck (BB), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.





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Specify PALNUTS on new lines—add PALNUTS to existing lines, without disturbing regular nut. Eliminate further re-tightening and checkups. Hot Dip Galvanized finish, in all utility sizes.

PALNUTS for terminal connections

Used on transformers, switches, disconnects, etc. Keep terminals tight, eliminate spring washers, assure full conductivity. Plain, Parkerized or Duronze according to needs.

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1. Extra wide phase clearances.
2. Independently removable one piece porcelain bushings.
3. Bushings clamped to bell body, not cemented.
4. Adjusting nut on terminals to compensate for errors in cutting cable leads.
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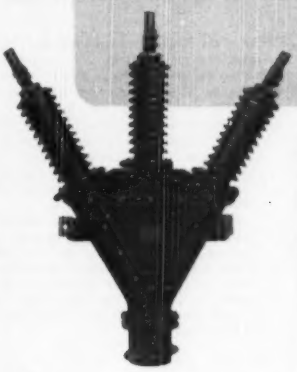

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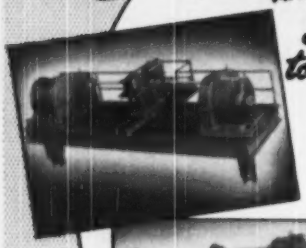

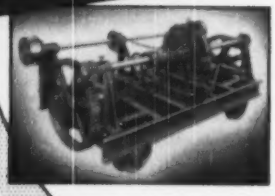

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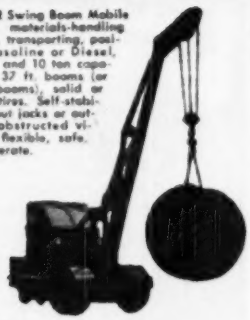

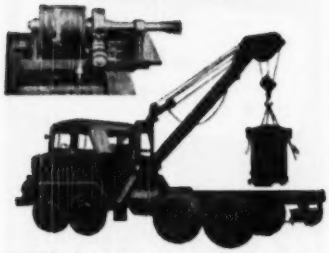

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O., Clyde—Village, E. G. Wells, mayor, imprvs., expand municipal electric sys., incl. installation 2 dual fuel diesel generating units, each with 250 kwh capacity. **$470,000.**

R. I., Providence—At office M. L. Rutter, Commander (CEC) USN, Actnig Officer in Charge of Construction, First Naval Dist. Headquarters, 495 Summer St., Boston, Mass., installing transformers and motor generators at U. S. Naval and Marine Corps Reserve Training Center, Spec. 25481. Plans deposit $10.

South Dakota — Bureau Reclamation, Dpt. Interior, Huron, construct Huron-Fort Randall-Armour-Gavins Point-Sioux Falls-Brookings, 115 kilovolt transmission lines, Missouri River Basin Proj. Transmission Div., Spec. DC 3243.

Texas — Central Texas Electric Cooperative Fredericksburg, rural distr. lines, sys. imprvs., Gillespie Co. **$350,000.**

Texas — Poka-Lambro Telephone Cooperative, Tahoka, rural telephone sys. rehabilitation, Lynn Co. **$362,000.**

Texas—Rio Grande Electric Co-operative, Brackettville, rural distr. lines, sys. imprvs., Kinney Co. **$240,000.**

Tex., Hallettsville—City, enlarging electric light and power plant, **$300,000.** M. T. Boska, City Hall, city engr.

Low Bidders & Contracts Awarded

Georgia — Colquitt Co. Rural Electric Co-operative, Moultrie, 4 mi. 66 kv rural distr. lines, 15.4 mi. rural distr. lines, 23.4 mi. conversion and 1500 kv substation in Brooks and Lowndes Counties, to Leo T. Barber, Moultrie, **$89,933.** Bids 11/14.

Tex., Randolph Field—U. S. Eng., 606 Santa Fe Bldg., Galveston, Nov. 16, electrical substation, Randolph Field Air Force Base, Inv. No. 41-243-51-16 from Hargis Electric Co., Box 1823, Brownsville, **$77,935.**

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La., Baton Rouge—Ideal Cement Co., Baton Rouge, cement plant, **$4,000,000.**

Md., Camp Detrick—U. S. Eng., First and Douglas Sts. N. W., Wash. 25, D. C., munitions bldg., **$531,000**; decontamination bldg., **$403,000**; aerobiology bldg., **$540,000**; basic science bldg., **$902,000**; central boiler plant and laboratories, **$3,528,000**; civilian dormitory, **$174,500**; meteorological bldg., **$181,400**; maintenance shops, **$300,100**; storage shed, **$9,000.**

Mass., Springfield — City, P. Welfare Dpt., Dr. W. A. R. Chapen, chn., plans by Coolidge, Shepley, Bulfinch & Abbott, 1 Court St., Boston, brick, steel, concrete municipal hospital, **$10,000,000.**

Mich., Port Huron—Premier Pulp & Paper Co. of Canada, Sarnia, Ontario, Canada, paper processing plant, incl. pipe line under St. Clair River from Canada, **$16,000,000.**

N. Y., New York—New York City Housing Auth., 63 Park Row, Zone 7, plans by Rogers & Butler, 219 E. 44 St., Zone 17, Edenwald Housing, 40 buildings and crafts bldg. in blocks bounded by Grenada Pl., Baychester Ave., Schieffelin Ave., 229 St., Laconia Ave. and 225 St. **$16,034,500.**

Va., Newport News — Newport News Housing Auth., Newport News, plans by Williams, Colle & Blanchard, and Harrison, Ballard & Allen Associates, Melson Bldg., 600 housing units, **$3,600,000.**

Low Bidders & Contracts Awarded

Ill., Carbondale—State, State Capitol, Springfield, Nov. 9, life science, animal, industrial education, physical education and library bldgs., to Federal Constructors, Inc., 173 W. Madison St., Chicago. **$3,600,000.** Bids 11/9.

La., Lake Charles—Continental Oil Co., Oil & Gas Bldg., Houston, Tex., design and construction processing equip. for expansion program, to E. B. Badger & Sons Co., 75 Pittsburg St., Boston, Mass. Total est. **$10,000,000.**

N. Y., New York—Sutton 53rd Street Corp., c/o contractor, general contract 20 story luxury rental project for 390 families, on southerly exten. of Sutton Pl. between 53 and 54 Sts., to Paul Tishman Co., Inc., 595 Madison Ave. Approx. **$7,000,000.** Arthur Weiser, 20 E. 53 St., archt.

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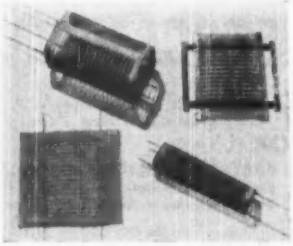

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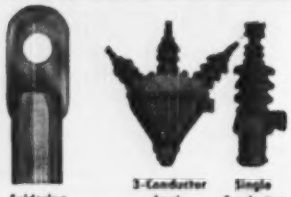

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Subtransmission Systems

(*Continued from page* 109)

perhaps even negative—for the lighter load density areas. However, the picture can change completely when such factors as load growth and adequate voltage control have been thoroughly analyzed.

III. Any Subtransmission System With Emergency Voltage Limitations

Consumer voltage under emergency conditions must go no lower than the safe starting voltage of single-phase motors—say 90 v. In urban areas an attempt is generally made to hold a considerably higher value under foreseeable, single-contingency conditions. A 100-v minimum is sometimes used. That figure as a system standard can sometimes place costly limitations on the allowable loading of circuits and apparatus.

Kilovar generation in the load area can be a surprisingly big help in overcoming emergency voltage drop limitations. An interesting example of this was covered by W. J. Lank, Potomac Electric Power Co (see Reference III). This case concerns the 13.8-kv supply to light-density primary networks. Though total circuit and transformer capability was entirely adequate to handle the load, loss of power to a 13.8/4-kv transformer caused unacceptably low voltage on the nearby load. Addition of 4-kv capacitors near that transformer, though having no appreciable effect on normal voltage, readily raised the emergency voltage to well above the acceptable value.

It may be somewhat dangerous to divorce the subtransmission system from both its source and its underlying distribution, but nevertheless, the following case roughly illustrates an emergency voltage condition which can become a limitation with loop subtransmission.

A. 34.5-kv Loop Subtransmission Fig 3) . . . Assume that system design permits no more than a 10% voltage change when one section of the loop is lost during peak load. On this basis, with load power factor 85%, this 32-mile loop can handle no more than 15 Mva of total load; ie, emergency drop at 13.3%, normal drop 3.3%, or a total change of 10%. By adding a total of 5,000 kvar of

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capacitors, the total load can be increased by 5,000 kva without exceeding these same voltage conditions, and it does not matter particularly whether the capacitors are switched or unswitched.

Theoretically, this emergency voltage change could be decreased at least 1% by accepting a higher normal drop, switching the capacitors and using them only in the emergency. However, the kilovar generator is generally too valuable, in terms of loss saving, to use it solely as emergency standby apparatus.

Of course, equal or better voltage conditions could be obtained by reinforcing the loop with 16 miles of new circuit—but at many times the cost. Obviously, if the additional 5 Mva capability can take care of the load growth for any appreciable length of time, the capacitors can pay for themselves by deferring circuit investment otherwise required.

B. Influence of the Distribution Underlying the 34.5-kv Loop . . . The distribution substations fed from this loop must include voltage regulators or load ratio control transformers. If the included ±10% voltage control is **completely** required to handle the voltage variations of the distribution system, then this 10% emergency drop limitation on the subtransmission system seems quite reasonable. Since at full load the substation voltage control is at full boost, it has nothing left to improve the low voltage caused by the subtransmission emergency. The 10% reduction must, therefore, be passed on to the consumer.

However, if that 5,000 kvar of capacitors is judiciously placed on the distribution circuits instead of the subtransmission system, and some of it is switched, the total 20% range of the substation voltage control may no longer be needed to handle the distribution requirements. If so, and if suitable taps are available on the distribution substation transformers, a portion of the 20% range is released to help out in the subtransmission emergency. It should then be possible to increase the allowable emergency voltage drop on the subtransmission system to something appreciably greater than 10%. It can, therefore, logically be claimed that if the capacitors are properly placed on the distribution system they will give a two-fold benefit wherever emergency

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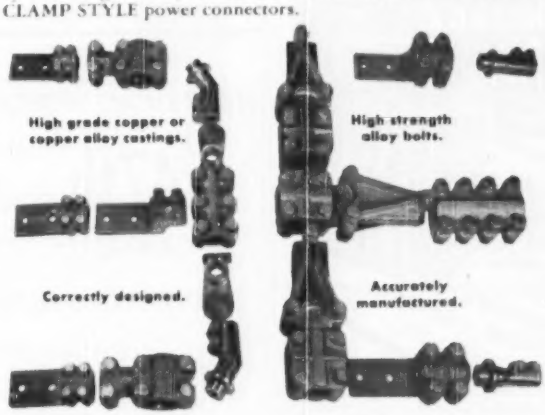

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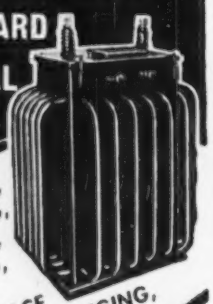

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voltage conditions are a limiting feature of subtransmission design. They perform the same actual voltage improvements as did the subtransmission capacitors of Fig 3, but, in addition, they can increase the allowable subtransmission emergency voltage drop.

C. Influence of the Source System Feeding the 34.5-kv Loop . . . The 34.5 kv source station may be a generating station. If so, the subtransmission voltage requirement can usually be handled by generator voltage control.

On the other hand, the source station may be fed from a high voltage system and we have a problem similar to that of the 69/13.8-kv subtransmission station of Section II. Is the load ratio control really required on the transformer stepping down to 34.5 kv? This question cannot be generally answered, but it is important to bear in mind that the underlying distribution capacitors can reduce the 34.5-kv bus voltage variations. In some cases at least, the plan for their proper use can eliminate the source station load ratio control—in a manner similar to that discussed in Section II.

REFERENCES

1. Smith and Michelson, of Commonwealth Edison Company. AIEE paper 49-172, Swampscott, 1949.
2. Falls, Blake and Woodrow. ELECTRICAL WORLD, September and October, 1948.
3. W. J. Lank, *1949 Transactions*, AIEE Volume 68, page 712.

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● DC MOTORS & GENERATORS: Type SK dc motor and generator line, 1 to 20 hp, is described construction-wise in a well-illustrated booklet. The motor is "taken apart" by means of successive illustrations on transparent cellulose paper, clearly showing the features of the Life-Line motor. Westinghouse Electric Corp, Motor and Control Div, Buffalo, N. Y.

● POLE BRANDERS: Electric and gasoline pole and lumber branders are illustrated and briefly described in a circular. Everhot Mfg Co. Maywood, Ill.

● THERMOSTATS: Type S bi-metal strip thermostats are illustrated on a catalog sheet. Typical thermostat response curves are given. Stevens Mfg Co, Inc, Mansfield, Ohio.

● INSULATING PLASTIC: An illustrated manual on Geon polyvinyl material includes a section on Geon 101, the basic resin used in electrical insulating compounds for wire and cable. B. F. Goodrich Chemical Co, 324 Rose Bldg, Cleveland 15, Ohio.

● OUTLETS: Following new catalog pages are available: Page 38-A, 3-wire fan hanger outlets; page 52-E, 2-wire grounding type weatherproof outlet; page 68-A, 10 and 20-amp switches; page 68-B, weatherproof plate for lock switches; page 62-A, 30-amp, 3-wire power outlet. Harvey Hubbell, Inc, Bridgeport, Conn.

● INSULATION TESTERS: Bulletin 2A gives data on 29 Vibrotest models having resistance testing ranges from 100 to 50,000 megohms with test potentials from 125 to 1,000 v dc. Associated Research, Inc, 3760 Belmont Ave, Chicago 18, Ill.

● WALL LAMPS: Form 710 shows 32 Wallamps, 20 of them new, including modern, traditional, and colonial designs. LaSalle Products, Inc, 145 Seneca St, Buffalo, N. Y.

● MOTOR STARTERS: Type ASR polarized slip-frequency field application relay is pictured and its operation described in Booklet B-4379 covering Slipsyn synchronous motor control and its protection of synchronous motor drives. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

● MOTOR STARTERS: Information about Type H motor starters for 2,300 to 5,000-v squirrel cage, wound rotor, synchronous, and multi-speed motors appears in Bulletin 14B6410A. Ratings go to 2,500 hp at 5,000 v. Bulletin 14B7303 contains information about air break contactor Type 256. It is adaptable where there is frequent starting, inching, reversing, plugging or dynamic braking. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

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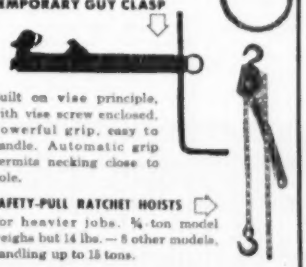

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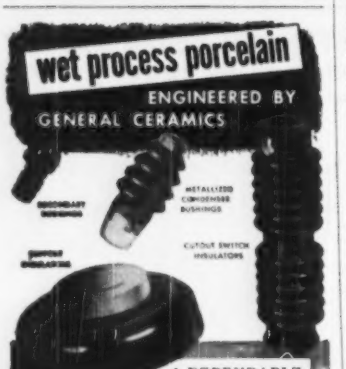

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Radiography—Papers and discussions of a session on radiography at the 52nd Annual Meeting of ASTM, 1949, have been published as *Papers on Radiography*. Some of the papers are "10 Mev X-Ray Technique", "Recent Progress in Flash Radiography", "A Revised Procedure for Establishing Radiographic Standards", and others. Publication STP 96, 100 pages, is priced at $1.75 from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

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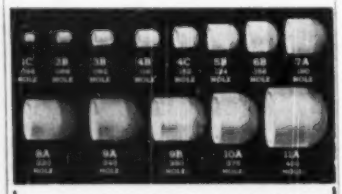
Electrical Contacts—The sixth supplement to the *ASTM Bibliography and Abstracts on Electrical Contacts* has been compiled by technical leaders from ASTM Committee B-4 on Electrical Heating, Resistance, and Related Alloys. The bibliography with all supplements is $6.75. The sixth supplement, Technical Publication 56-F, has 28 pages, and costs 75¢ from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.



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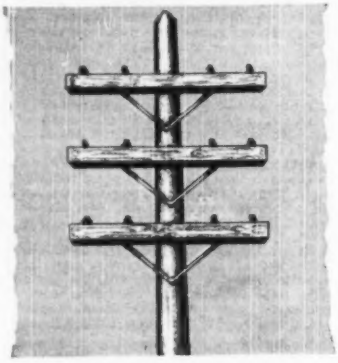

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(Continued on page 180)

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3	1000	Westg.	66000—7200
3	100	Westg.	44000—7200/12470Y
3	8333	Westg.	43800—13900
4	6667	G.E.	38100/66000Y—12700/22000Y
2	15000	A.C.	33000—12500, 3 ph.
2	7500	A.C.	33000—13200, 3 ph.
1	5000	G.E.	33000—2300/4600, 3 ph.
7	220	G.E.	33000—2300/6900
6	75	Mal.	33000/16500—2300/6900
4	450	A.C.	25410/44000—13280/2300
3	750	Westg.	13200—440
3	333	Westg.	13200—440
3	333	G.E.	13200—2400/4160Y
3	167	G.E.	7200/12400—240/480
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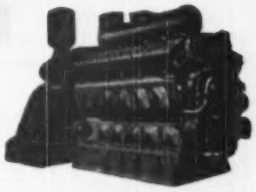

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937.5	General Motors	12-567	1200	720	312	Clark	MD-4	375	327
625	Alco	6-134x18T	750	600	187	Ingersoll Rand	8	238	514
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1	1500	G.E.	300	275	2200/4400
1	1500	Whse.	600	600	4150
1	1000	Whse.	514	600	2300
1	1000	Whse.	900	900	4150
1	750	Whse.	900	275	2300/4150
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1	500	Whse.	900	250	460
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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4150V, 2400V
1—1000 KVA G.E., 3 Ph., 4150V, 2 Ph., 2400V
1— 500 KVA Kuhlman, 1 Ph., 4150V, 2300V
3— 400 KVA G.E., 1 Ph., 6900V, 2300V Sec.
3— 100 KVA G.E., 1 Ph., 4150V, 240/480 Sec.
3— 75 KVA Whse., 1 Ph., 2200V, 440V Sec.
1— 75 KVA G.E., 3 Ph., 2400V, 240/480V Sec.

MOTOR GENERATOR SETS

2—1500 KW G.E., 600V, 600 RPM, 4000V Syn.
2—1250 KW G.E., 275V, 600 RPM, 4000V Syn.
1—1000 KW G.E., 600V, 514 RPM, 4000V Syn.
2— 150 KW G.E., 125/250V, 1200 RPM, 4000V Syn.

SLIP RING MOTORS

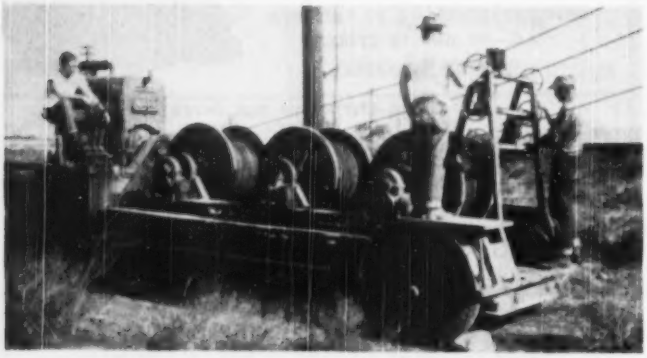
1—2500 HP G.E., WT, 257 RPM, 6600V
1— 500 HP G.E., WT, 720 RPM, 2200V 4100

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2200V with D.C. Exc.

Large Stock of A.C. and D.C. Equipment

LETTERS TO THE EDITOR



Three R's of Safety

To the Editor:

A trailer outfit with three power-driven reels was featured in the upper righthand corner on page 99 of the October 9 issue of **Electrical World** with an article entitled "Safety in Stringing" by Mr. Eldon E. Beck, safety director, Idaho Power Co, Boise, Idaho.

I am now using a single power-driven reel and have been toying with the idea of making a setup of three power-driven reels. I would appreciate any information you can furnish me as to the company that has projected or is using this idea.

Frank S. Clark
Supt of Construction
Eastern Division
Pennsylvania Electric Co
Altoona, Pa.

(Editor's Note: The picture in question (above) shows equipment in use by Southern California Edison Co.)

To the Editor:

I have just finished reading "The Three R's of Electric Utility Safety" as published in the **Electrical World.** May I commend you and your staff. This, in my opinion, is an outstanding contribution to safety in the electric utility field. It tells our safety story most efficiently. It will do much good.

E. J. Kreh
Manager
Accident Prevention
Duquesne Light Co
Pittsburgh, Pa.

To the Editor:

I have just had the opportunity to review the triple R Safety Section in the October 9th issue of **Electrical World** and certainly want to congratulate you for what I believe is a splendid contribution to the efforts of the Edison Electric Institute Accident Prevention Committee to get our story more effectively communicated to the people who need this in order to avoid unnecessary injury.

George J. Ruoff
Safety Engineer
Central Hudson Gas & Electric Co.
Poughkeepsie, N. Y.

Our New Type Face

To the Editor:

Let me cast a vote in favor of your new type face. It looks good and is more legible.

John H. Ronayne
Better Light Better Sight Bureau
New York, N. Y.

(Editor's Note: Thank you! Type style is Times Roman.)

Too Many Hours?

To the Editor:

In your issue of October 2, page 16, you print Southern California Edison Co, Hydro Plant Capacity 441,020; Hydro Generation 4,145,506.

This means 9,400 hours of operation.

There is some error in these figures.

M. Radt, Dr. S.
City College of New York
Amsterdam Ave at 138 St.
New York City

(Editor's Note: There is no error! The 441,020 kw of hydro capacity listed by FPC for Southern California Edison Co does not include 495,000 kw of capacity that the company has "leased from others.")

That Boston Outage

To the Editor:

I assume that you are not adverse to giving your readers a laugh on a technical subject. I am sure the New Yorker could have devised no funnier drawing than the one published in the Boston Herald this morning as an interpretation of Boston Edison Company's official explanation of the serious blackout which occurred here last night. I enclose a clipping from page 6 of this morning's Herald.

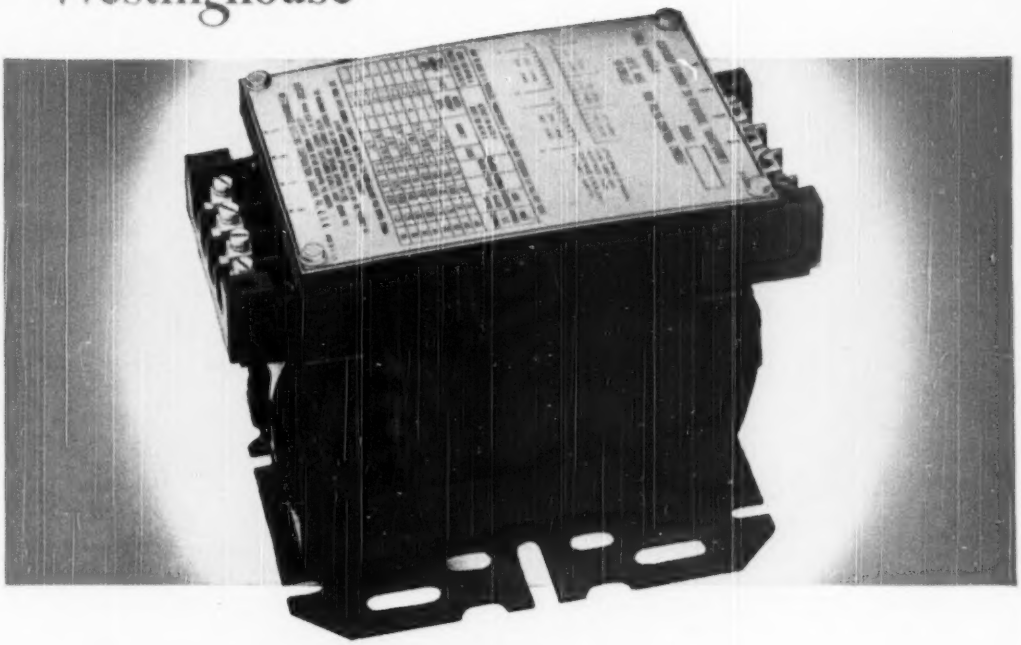
W. F. Ryan
Stone & Webster Engineering Corp
49 Federal St
Boston, Mass

(Editor's Note: The actual cause of the interruption to Boston's power supply on November 19 is described on page 19 of **Electrical World's** issue of November 27.)

THE CAUSE of the outage as the "Boston Herald" understood it

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



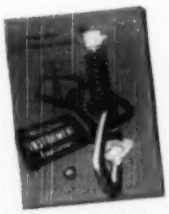
TRANSFORMER

with a Thousand-and-One Uses!

Here's the transformer that eliminates the need for large stocks of auxiliaries.

One type—*available from stock* in nine multi-ratio designs—covers 95% of all auxiliary transformer applications. Used as a current transformer for matching currents of various magnitudes or phase relationships . . . also used as a potential transformer. Special ratios easily obtained by connecting the windings as auto transformers.

Save the cost of maintaining excessive inventories. For specific information on designs available, contact your Westinghouse representative, or write for CS 45-306. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-70566



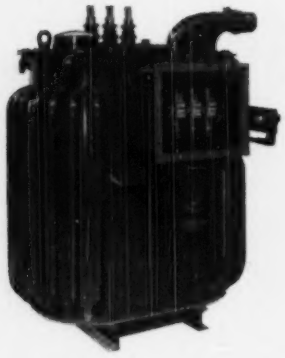
THE MOST COMPLETE LINE IN THE INDUSTRY

Write for your copy of Booklet B-4319, "Westinghouse Instrument Transformers". Concise, profusely illustrated, with a pictorial cross reference to descriptive literature on the individual transformers that make up the most complete line in the industry.

Westinghouse

INSTRUMENT TRANSFORMERS

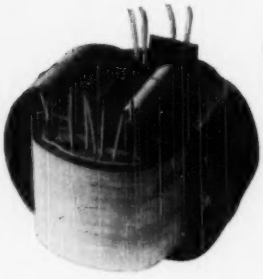
HOW SAF-T-KUHL TRANSFORMERS PAY FOR THEMSELVES



Kuhlman Saf-T-Kuhl Transformers are 100% safe because they are filled with an inert, non-inflammable, non-explosive cooling fluid. This feature pays these ways:

1. Eliminates expensive vaults.
2. Makes it possible to install units with safety anywhere in a plant so that available floor space can be used for productive uses.
3. Saves cost of secondary line copper conductors by permitting circuits to be split into several sections with a transformer the center of each.
4. Reduces power losses since Saf-T-Kuhls can be located near load centers.

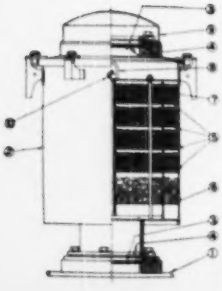
In fact, you save in so many ways that Saf-T-Kuhls often soon pay for themselves! In addition, Saf-T-Kuhls feature the same high quality workmanship and materials found in conventional Kuhlman transformers. The cooling fluid itself is a patented synthetic compound perfected after months of experimentation and testing in the field. It is equal or superior to transformer oil in dielectric strength, fluidity and thermal capacity, and does not have oil's tendency to sludge.



Kuhlman's famous Bent Iron Core, made of oriented steel, provides a smaller, lighter transformer in units through 25 KVA. Exciting current is reduced as much as 75%, too, over butt joint cores, by the Bent Iron Core's lapped joint construction.

Typical of the way Kuhlman builds quality into its transformers is this new tap changer with which all Saf-T-Kuhls are equipped. The outstanding feature of this new tap changer is the self-aligning spring clips on rotary blades which engage heavy stationary blades, thereby providing double surface contact under substantial pressure.

Saf-T-Kuhl distribution transformers are available in NEMA standard ratings of 3 through 3333 KVA single phase and 9 through 3750 KVA, three phase, through 15000 volts. For complete data and specifications on Saf-T-Kuhl transformers, write for Bulletin CS-501. Bulletins on Conventional, Power, Dry Type, Street Lighting and Specialty transformers in the Kuhlman line also available on request.



Gas absorbers are available on all Saf-T-Kuhl transformers at extra cost. This device is mounted on the transformer cover and contains a refillable granular material which effectively absorbs all gases before relieving abnormal pressure through the relief diaphragm.

1 Transformer Tank Cover. 2 Gas Absorber Tank. 3 Glass Diaphragm. 4 Diaphragm Gaskets. 5 Perforated Metal Trays for Soda Lime. 6 Perforated Metal Tray for Chipped Marble. 7 Anchor Rods. 8 Lifting Eye. 9 Protective Hood. 10 Test Valve.

EXPERIENCE COUNTS — THIS IS OUR 56TH YEAR

Kuhlman

KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,* **67 Broad Street, New York 4, N.Y. Cable Address, Microphone, N.Y.**